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The Mining Journal,

RAILWAY AND COMMERCIAL GAZETTE:

FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.

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Original Correspondence.

CLEVELAND:

ITS PAST, PRESENT, AND FUTURE, IN RESPECT TO ITS MINERALS AND MANUFACTURES—NO. VI.

Having submitted details of the various inventions which largely contributed to the development of Cleveland, it may be of interest to glance at their influence upon the iron trade of that particular locality. It is universally admitted that every invention of value when once thoroughly introduced soon produces effects which may either consist of a saving in the material used or in time and labour, and, consequently, in money. Cleveland ironmasters, therefore, when they had increased the size of their blast-furnaces, and the temperature of the blast, and had improved their heating-stoves, almost immediately witnessed an improvemeut in the working of their furnaces, by an increase in the yield and a proportionate decrease in the material used, which, however, was still more perceptible when the balance-sheets were completed at the expiration of the respective financial periods. It was then evident these were real improvements. Hence, they were enabled to produce iron at a considerably less cost than their formidable rivals the Staffordshire firms, and were soon in a position to greatly influence the market, not only in respect to the differences in the cost of production, but also as regarded the quantity of pig-iron produced.

Staffordshire and Wales, when Cleveland commenced its career, monoplised the iron trade. The firms had introduced certain improvements in their systems of manufacture from time to time which had been of immense value, and had adopted the most approved inventions to increase the efficiency of their plant, and had attained a position unequalled in their previous history. It was then that they became somewhat indifferent, and, as we have elsewhere remarked, regarded the attempts of Cleveland ironmasters with amusement rather than anxiety. It was then they commenced the period of their decline. They appear to have acted upon the fallacious argument, that when once a district is great it will always be great, and that no special effort is requisite to maintain supremacy. France was the greatest military nation in the world at one period of her history, and had she continued to devote the same amount of attention to those matters which authorities mention as being essential to the perfection of an army, in point of training, &c., as she had in the previous period, her position would have been far different to that which she occupies at the present time. Yet we invariably find that whenever a nation is advanced to a certain point there is less of that determination exhibited than previously. It was thus with ancient Rome, and with many other nations of antiquity: it was thus with France, and we shall be surprised if Germany proves an exception.

Staffordshire and Wales had attained so high a position as to induce the ironmasters to believe they would ever retain their iron trade supremacy, and they, therefore, were slow to introduce improvements. Cleveland, on the other hand, had a position to gain, and her ironmasters readily adopted such inventions and improvements as were calculated to promote their interests. Hitherto the iron trade had been in the hands of those two districts, but now the new district was producing a large quantity of pig-iron, and this seriously affected the former localities. Many of the consumers now gave their orders to Cleveland, as the iron was considered an excellent mixture. Thus the district was obtaining a valuable connection, and was securing a position which had not many years hence to be equal or superior to that held by Staffordshire and Wales. With the opening out of Cleveland several new industries were commenced, the chief of which, of course, was the manufacture of iron. The mineral trade was, therefore, developed. The consumption of coal had formerly been very small, there being comparatively few manufacturing concerns, and it was used principally for household purposes. At that period a considerable quantity was shipped from the ports of Stockton and West Hartlepool to London, Lincolnshire, and the Continent, and high prices were not realised for coal consumed within the district, whatever may have been paid by merchants at the ports to which the coal was shipped. However, the coal trade experienced an important change. The consumption of coal in the various blast-furnaces, rolling-mills, foundries, bolt, nut, and rivet works, and other manufacturing establishments, was the means of developing the coal trade of Durham immensely. New seams were opened out, and existing ones were worked more than hitherto, and as the demand increased prices increased proportionately.

Coke is the principal fuel used in blast-furnaces, and, therefore, as Cleveland progressed, this branch of industry was materially influenced. Previous to the opening out of Cleveland the quantity of coke consumed within the district was very trifling indeed, but the coke trade received a great impetus, and increased to the same extent as the iron trade. Coke ovens were erected at nearly the whole of the collieries in South Durham, and in those the most recent improvements were introduced. It was soon apparent that the coke trade was more remunerative than that of coal alone, and, therefore, many firms embarked largely into it, and the demand indeed was larger as fuel for blast-furnaces in the early period than for coal.

As soon as the value of the mineral deposits in the Cleveland hills was made known they were as soon worked to a surprising extent, and royalties were obtained by firms who had already erected blast-furnaces in the neighbourhood. And as the production of pig-iron increased the ironstone mines increased proportionately.

Limestone, also, was in great demand, for it is closely associated with the manufacture of pig-iron, especially in Cleveland, where about 1 ton is used to every 4 tons of raw ironstone, and to 1 ton of pig-iron. In various places large quarries were opened out, and, in short, the whole range of hills was under requisition, and the hills containing rich minerals, which had hitherto been deemed unimportant, had become to be highly prized. And as the demand for minerals increased within the locality, and puddling-furnaces were erected, and finished iron also made, various experiments were tried with the view of ascertaining the class of iron which might be produced. For this purpose samples of Scotch, Cumberland, Staffordshire, and Welsh ores were obtained, and the results carefully noted. Samples of foreign ores were also imported as Cleveland advanced, and it was observed that good results might be obtained by a judicious admixture with those of the district under notice. To those experiments we are indebted for the Spanish, Descada, Norwegian, and Swedish ores, now imported into the iron-producing districts of this country in immense quantities annually. Some of these ores were of little or no value whatever at the ports of loading, and, indeed, were only used as ballast for vessels, and could, therefore, be purchased at a mere nominal sum; in many instances the ore was discharged into the rivers of the northern ports, and the captains had to pay for unloading it. But a change took place, which altered its position materially. As Cleveland ironmasters noticed the results produced from certain experiments they decided to use the ore with local ores, and the foreign ores soon became of value, until now the Spanish ores, once without value, realise from 16s. to 20s. per ton in the English market. These changes in the value of ores are traceable to the improvements and inventions of Cleveland ironmasters with respect to the processes of iron manufacture. The railway company granted special facilities for the importation of those ores, and endeavoured, as far as was practicable, to meet the immense requirements of the district. A railway company is a powerful auxiliary, and, indeed, the prime mover of a district, and in a great measure the success of any locality depends upon the relations between the directors and the firms engaged in the various manufactures.

It is difficult to conceive a greater drawback to trade than a railway company when its directors consist of those who, for some petty cause or other, endeavour by all possible means to oppose everything which would have a tendency to promote good feeling amongst every class, and to prevent the district meeting its rival manufacturers and merchants in other places on equal terms. Such a course of proceedings on the part of railway directors is deserving the censure of the shareholders, whose interests the directors are opposing by placing barriers in the stream of commerce, upon which their dividends depend. It may, however, be questioned whether such an instance ever occurred in the railway history of our country. We can easily understand how possible it is for a clerk or other official in the Civil Service, or private firm, not to receive his promotion when he was legally entitled to it, but because of not having conformed to some perhaps trifling matter his promotion is to stand over. Or it is not difficult to understand why some gallant officer in Her Majesty's service has not been promoted, although he has been mentioned in many despatches. In his case there is someone high in authority who is doing all he can to punish the person who once dared to act in a manner contrary to his wishes or instructions. In these instances the cause is clear to everyone.

Now at the risk of being accused of entertaining strange ideas, we venture to assert that the wheels of progress in numerous districts are subjected to exceedingly heavy drags, simply because of some petty personal interests between the directors and a few of the firms within the district. Yet this is a fact beyond dispute, and could we but fully investigate the relations of many of our railway directors with our manufacturing concerns it would no longer be a matter of surprise why this district or that district does not prosper. But the most difficult part of the affair to understand is why a whole community should be deprived of those privileges which the railway company, in obtaining permission to construct their lines, stated they would offer, and when the grievance may rest entirely with only two or three persons in a town or district having a population of several thousands. A railway company ought always to study the interests of every district traversed by their line; to do otherwise is a great act of injustice; nay more, it is dishonest.

The Stockton and Darlington Railway Company has, on the whole, considered the interests of the various trading communities in the district, knowing full well that their interests were alike; and were all to think so, what an improvement would be effected in the commercial centres of our country!

The question, How shall we still further assist in the development of Cleveland? was ever asked by them. Nor did they simply ask the question and rest there, the same as the policeman of whom we have heard, who, having seen the origin of a fire, whispered "Fire, fire," without endeavouring to extinguish it. They applied themselves thoroughly to the working out of the idea—the development of Cleveland—and observe the result.

At the commencement of Cleveland as an iron-producing district, inclined planes were throughout the entire length of the Stockton and Darlington line; but as the trade increased, and the district began to be developed, these were speedily replaced by the more modern locomotive lines. Various other improvements in the permanent way and the rolling-stock were introduced to advantage, and everything essential to the efficient working of a large traffic was promptly supplied. The rates were considerably modified, in order that Cleveland firms might be enabled to meet their rivals in Staffordshire at those towns in the North and West of England previously supplied by Staffordshire alone.

As soon as those efforts on the part of the directors were fairly tried it was found, as a natural consequence, that their traffic dividends rose to 10 per cent. per annum The vigorous and enlightened policy pursued by the Stockton and Darlington Company emanated from the mind of Mr. Joseph Pease, than whom no man has, perhaps, done more to advance the mutual interests of a railway company and district, and was administered by an able and enthusiastic staff of managers, all desirous of contributing to the development of the district. Upon this they had fixed their minds, and scarcely anything could withdraw them from the enterprise. Nor did they fail. Other railways had had as successful a beginning, but from some reason or other had not run so smoothly, and, indeed, were on the verge of bankruptcy. In Cleveland there was a reciprocity of interests, each in his turn anxious to help the other, and hence the district progressed.

The firms were deeply interested in every project for improving, extending, and cheapening the railway accommodation of the district in which they carried on their business, as they could not possibly over estimate its importance. The railway company were, on the other hand, deeply anxious to promote the interests of the firms in every possible manner, as they were assured that every pound expended would be highly reproductive. Thus the two united, and unity was indeed strength.

Nothing is of greater importance to an iron manufacturer than the rates levied by the railway company, as these may either be prohibitory to the trade, or may promote and develope it. Fuel forms one of the chief items of expense in the manufacture of iron, and a rate of 3d. per ton in excess may frequently be the means of restricting trade, and placing the firm in an undesirable position. Hence the railway companies' schemes were closely watched, and whenever anything occurred which was believed to be prejudicial to the manufacturers' interests, on suitable representation being made redress was at once obtained by removing the grievance. The firms of the district never lost any opportunity for urging upon the railway company every practicable idea for increasing the shipping facilities at the respective ports, for reducing their rates in order to compete with other districts, and in every matter which concerned their interests. The construction of railways in various parts of the world is bringing together classes of society who have until now been without that constant interchange of ideas and common-sense offices of kindness so desirable between nations and individuals in order to promote their mutual interests.

From the commencement of the Stockton and Darlington Railway the many advantages arising from this freedom, and familiarity, and mutual interchange were apparent; and everything calculated to yet further improve the relations between each class of individuals was introduced. This mutual intercourse between men of business is of service in adapting the manufactured article to the taste or requirements of the consumers, and whenever this can be accomplished a certain and rapid development of business ensues. Cleveland is indebted to her means of communication with other districts for her high position in regard to minerals and manufactures. It is true she does not enjoy so ample a railway system at the present period as could be desired, but the district cannot complain much on this matter. In the earlier period, when the railway system was in its infancy, when a network of railways did not extend throughout the length and breadth of Great Britain, as now, Cleveland possessed superior advantages to other districts, and it is to that period we more particularly refer.

[*To be continued in next week's Mining Journal.*]

BIRMINGHAM, AND THE BLACK COUNTRY—No. XVII.

THE SOUTH STAFFORDSHIRE COAL FIELD, AND ITS EXTENSION.

If a person having no knowledge whatever of the district were transported to the court yard of Dudley's old Castle, or put down in the midst of the leafy groves that surround it, without getting a glimpse of the veritable Black Country encompassing them on all sides, their minds would naturally be led back to the good old times, when the massive structure that rears itself up so majestically upon its Silurian foundation, and overlooks a vast extent of territory, was tenanted by some lordly owner, who lived up to the rare Old English style, and bestowed his bounties on those around. They could stand there amongst the ruins in the old court yard, and almost picture to themselves the tournaments and revels that, no doubt, were carried on at this spot in years gone by. The thought as to the character of the immediate neighbourhood would necessarily suggest itself; and, judging from the umbrageous avenues, and the picturesque spots, made so beautiful by nature, that are in close proximity to the ruins, and are, in fact, extended for quite a mile in one direction, they would expect to see a rural district given up to agriculture; but this idea would soon be expelled by ascending to the top of the Castle keep, where a magnificent view of the surrounding country can be gained, and seeing the clouds of smoke vomited forth from the chimneys of the ironworks and collieries, and surprise would be great to find the busy town of Dudley, with its almost 50,000 inhabitants, stretched out within a stone's throw of their feet. Here, then, is opened up to view that hive of industry, the Black Country, the cradle of the iron trade, which still holds the supremicy for producing iron of the best quality, and depends almost entirely for its mineral resources upon the South Staffordshire coal field. It may easily be imagined what a drain there has been upon the mines of this field, when it is remembered that the district is dotted over with finished ironworks, blast-furnaces, and other manufactories using enormous quantities of fuel and mine; and till late years economy has been a thing out of the question. This enormous consumption has almost exhausted the minerals of the old coal field, and that great reservoir of carboniferous matter—the Thick, or Ten Yard, coal, which has been the glory of the Black Country—has nearly all passed away in smoke; and it is only such proprietors as the Earl of Dudley that have any great quantity in reserve. Such a state of affairs has, naturally enough, made those whose prospects depend upon a ready supply of coal and mine, alive to the fact that other sources must be sought after to take the place of those that are gradually dying out. None have worked more assiduously for this object than the members of the Dudley Mining Institute; but we must not forget to mention that much has also been done by the sister Institute at Wolverhampton.

Mr. Henry Johnson, the hon. sec. of the former society, read a very able paper upon "The Geological Features of the South Staffordshire Coal Field, with Special Reference to the Future Development of its Mineral Resources," at the last meeting of the Iron and Steel Institute, at Dudley, and no one is better able, or could have treated the subject in a more masterly manner than he did; but the subject is a wide one, and of great importance, and Mr. Johnson was only permitted in a paper that was limited to time, there being so much business before the meeting, to little more than a glance at several interesting matters; in fact, fresh discoveries have been made since the reading of the said paper, which give further evidences upon and will further substantiate the conjectures of Mr. Johnson. It is our intention to treat briefly of the geological features of the South Staffordshire coal field, and particularly notice the prospects of its future extension, and what is being done in this direction. The following formations enter into the geological formations of the district:—The Silurian rocks of the Primary or Palæozoic formations, the Coal Measures proper, the younger portions of the Carboniferous series, the Lower Red Sandstone, or Permian, and the New Red Sandstone of the Secondary, or Mesozoic, formations. These are the aqueous rocks; then of the igneous rocks we have the Columnar Basalt, the intrusive Trap or Green Rock, and the same rocks in a decomposed state, forming a description of marl. It will be noticed that between the Silurian and the Coal Measures there is an entire absence of the Millstone Grit, the Carboniferous or Mountain Limestone, and the Old Red Sandstone. The theory of the late Mr. J. Beete Jukes, in explanation of the absence of these measures, is a very plausible one, and his views upon this subject are almost generally coincided with. He compares the constitution of the carboniferous rocks in South Staffordshire with those in the North Staffordshire coal field, only about 20 miles distant, and shows what a difference there is between them. In the southern field the carbouiferous rocks consist of coal measures only, and do not in any instance seem to exceed 1000 ft. in thickness,

whilst in North Staffordshire these beds are much more numerous, and attain an aggregate thickness four or five times greater. Large masses of sandstone are found to be at the base of the coal measures proper, and are termed the Millstone Grit. Towards Derbyshire thick beds of black shale are found below this, interstratified with thin limestone; and from below these come out an assemblage of beds of pure limestone several hundreds of feet in thickness, forming all the beautiful hill country that spreads from Dovedale to Matlock, and thence to Castleton and Buxton. This group of rocks is the Mountain or Carboniferous Limestone, and the black shale intervening between it and the Millstone Grit is the Upper Limestone Shale. From Derbyshire the Carboniferous Limestone, either in its simple form of a series of beds of pure limestone, or in a more confused state, mixed up with seams of shale, or sandstone, extends to Scotland, with a mean thickness of something like 2000 ft.; and it is again found as a simple limestone in North Wales, and also in South Wales, and in some of the adjacent English counties, varying in thickness from 500 to 1000 ft. The Coal Measures of South Wales are of a great thickness, quite 7000 ft., and in some places 12,000 ft.; and at the base there is the sandstone beds of the Millstone Grit in great thickness, and above it other beds, called the Pennant Grit. The Carboniferous Limestone forms the lining of the basins of the South Wales and Forest of Dean coal fields, and from these there rises up on all sides the Old Red Sandstone, and of this formation whole mountains are composed, some of them nearly 3000 ft. high, so that it is inferred that these strata are in some places 10,000 ft. thick. These vast formations of Old Red Sandstone and Carboniferous Limestone, as well as the Millstone Grit, are entirely absent in South Staffordshire, and, in fact, in a whole tract of country stretching from east to west through the centre of England from Leicestershire through Warwickshire, South Staffordshire, North Shropshire, into Montgomeryshire. These old measures each die away both north and south as they approach this defined strip of country. They were, there is no doubt, deposited under water, and there is special proof in the case of the Carboniferous Limestone it must have been laid in the sea, as it is made up almost entirely of marine animals. Now, here is Mr. Jukes's theory. He supposes that the area to which these measures thin out and terminate was not under water, but formed dry land. It is, he says, in fact almost certain that while the sea flowed deep over the remainder of that space where England and Wales now exists, during the periods when the great formations of Old Red Sandstone and Carboniferous Limestone were in course of deposition, a narrow promontory, or an island, or a group of closely connected islands, ran in a line from east to west across the districts pointed out. This land, however, must itself have been depressed, either wholly or in part, while the Coal Measures were being deposited, and, as it slowly sunk beneath the water, sheet after sheet of Coal Measures extended over it, till, perhaps, the whole neighbourhood was finally buried under one wide-spread subaqueous Coal Measure plain. Since that time it has not only been lifted up again, but broken, dislocated, and contorted by forces of disturbance acting from below, and worn and eroded by denuding agencies acting from above; fresh formations have been deposited over it, and these also with the subjacent rocks broken and again denuded, till all likeness of its former state has been utterly destroyed, and its former condition left to be guessed at solely by deductions drawn from the relations which can be traced between the formations of which it is composed. The last two or three sentences are Mr. Jukes's own words. We give them, as they very briefly and clearly embrace the general geology of this country since the Carboniferous age.

Taking the rocks in succession as we find them in this central coal field, we have the oldest, those of the Silurian formation. These rocks form the foundation of and underlie the whole of the coal measures, as is proved by deep sinkings in the central portions of the field, which in all cases come upon the Silurian measures after going through those of the coal series. Large prominences of the Silurian strata compose what are known as the Dudley Castle, Wren's Nest, and Hurst Hills, and these are formed of the Wenlock or Dudley rocks, being entirely limestone and shale. At these places there are two workable seams of limestone, the Thin and Thick, or Upper and Lower, the former averaging about 8 yards thick, and the latter about 13 yards. Both are extensively worked, and the produce is used principally as a flux in the blast-furnaces of the district, but to a less degree, after being burnt, for agricultural and building purposes. A hill, the Sedgley Beacon, standing between Dudley and Wolverhampton, shows the Wenlock limestone, but over it there is a younger member of the Silurian group, the Ludlow rocks, which also appear at Hayes, near the Lye Waste, Stourbridge, and contain a band of limestone from 20 to 25 ft. in thickness, locally called the "Brown Lime," whilst the Wenlock stone is called the "White Lime." Jukes says, from its containing the *Pentamerus Knightii*, and other fossils, and from its position, it is with great probability identified with the Aymestry limestone. A peculiarity about the Wenlock limestone is its division into two bands by a bed of shale, and that all three stratum contain the same fossils. The Silurian rocks, after passing under the coal measures, again rise to the surface in the neighbourhood of Walsall, and there the Wenlock limestone crops out, and the country is covered for a long distance by the underlying shale, till a lower measure, known as the Barr limestone, rises to the surface at Hay Head, near Great Barr, and from the lay of the rocks it is estimated that the natural position of the Barr limestone below the Dudley, or Wenlock, would be about 500 or 600 ft. The Hay Head, or Barr limestone, is thought by Prof. Ramsay, and with good reason, to be equivalent to that at Woolhope, in Herefordshire, which lies at the junction of the Wenlock and Llandovery rocks, and at a few small quarries near Barr and Hay Head a yellow or brown sandstone is exposed to view, which is considered to be no other than the Llandovery sandstone. West from Walsall, on the coal field side, no older measures of the Silurian than the Wenlock have been found. It is pretty evident from these circumstances that the coal measures of the South Staffordshire district rest upon the Silurian formation, though not conformably. In speaking of the absence of the Old Red Sandstone, the Mountain Limestone, and the Millstone Grit, we showed how these measures were deposited against an island or islands of Silurian formation, but that these must have become depressed during the deposition of the coal measures, and that probably the whole country was buried under one wide-spread subaqueous coal measure plain.

Now, the question may be asked, How comes it that there are hills of Silurian measures, such as Dudley Castle, Wren's Nest, &c., entirely uncovered by coal measures? It would have seemed plausible that these were never submerged, and that the coal measures were deposited around them; but this is not the case, as an examination of the "crop" of the coal will show. Had the measures been deposited against the Silurian bank they would have gradually and peacefully terminated against it; but as it is they finish abruptly, and there is every evidence that the Silurian measures have been forced through them by some internal disturbance. At a portion of the "crop" we lately examined, where the termination of the New Mine coal against this bank was exposed to view, the coal was above its usual thickness, and the end of it was turned upwards, in a sort of curl, with a clean sweep, bringing the end with the measures vertical, almost upon the top of the horizontal part, a little behind it; nothing but a sudden upheaval breaking through the measures would create this peculiar phenomenon. That there have been many extensive disturbances since the coal measures were deposited is evidenced by the numerous faults, especially those defining the east and west boundaries of the coal field, and these Silurian prominences have no doubt been thrown up by some of the minor ones. The coal field, as far as it is at present explored, extends nearly due north and south, and is about twenty-three miles long by six broad. The main boundaries, those on the east and west, are extensive clean cut faults, with some evidences of denudation; but we shall speak fully of the nature of these, and their bearing upon the discovery of coal beyond the present known limits, when noticing the probable extension of the coal field. The western boundary fault, starting from the most southern point, near Pedmore, passes through Stourbridge, Kingswinford, Sedgley, Wolverhampton, Essington, Cannock, and Rugeley, somewhere near which point the east and west faults unite; but from here down to Brereton, and still further south on the west side, the coal measures are covered by a drift deposit, termed by the Ordnance Surveyors quartzose gravel and unconsolidated conglomerates of the New Red Sandstone. On the east the boundary fault runs from Rugeley past Brereton, Cannock Chase, Brownhills, Aldridge, West Bromwich, Oldbury, down nearly to Frankley Beeches, from whence it goes west to Pedmore, forming the southern boundary. The north and south boundaries differ materially from those east and west, as they give strong evidence of being formed by denudation, and are consequently indented coast lines; whilst it is pretty generally acknowledged now that the latter, the main ones, are clean cut faults, either formed by the lifting up of the coal field, or the depression of the surrounding measures.

The coal measures are not persistent over the whole field, for they differ considerably in the several neighbourhoods, and it is remarkable what great alterations take place in a short distance. The main seam of coal, the Thick or Ten-yard, is the finest specimen of carboniferous deposit in Great Britain, but it is only in the south central portion of the field that it is found to perfection. In the extreme south of the field this wonderful seam, or rather combination of seams, degenerates very much, and is split up by intervening beds of foreign matter, and is nearly worthless, but a recent discovery, which we shall afterwards speak of, will perhaps show that at some points the coal yet exists in an almost perfect state, and will shortly be gotten. Here the beds of ironstone, so rich in other parts of the field, are entirely absent, but there exist two beds of exceedingly fine fire-clay that are of as much value as the Thick coal, even in its prime. South central the Thick coal is in its greatest perfection, without hardly any parting, the measures of coal above it are workable, and also those immediately below it in some parts, with the accompanying ironstone measures, whilst the deeper measures are either wanting or very poor in quality. In the north central portion, about Bilston and Wednesbury, the Thick coal, and other measures near it, "crop out," and those that are deeper become thicker, and exceedingly rich in character. At Bentley, where the great Trough fault occurs, there is a downthrow to the north of 120 yards, and an upthrow in the same direction of 23, bringing in again the Thick coal, and other measures of coal immediately above and below it, but no ironstone. These coals are not in their original state, as found in the northern portion of the field, but are divided into a series of valuable beds, which run through the coal field to the extreme north, through Pelsall and Cannock Chase. The following Geological Survey section clearly sets forth the measure in the southern and central portions of the South Staffordshire coal field, and gives the respective thicknesses:—

	Ft.	Ft
Beds above the Upper Sulphur coal	600 to	800
Upper Sulphur coal, about		1
Intermediate measures		140
Little or Two-ft. coal		2
Intermediate measures, from	2 to	48
Brooch coal, about		4
Brooch binds, ironstone measures, from	7 to	20
Herring coal (not known North of Dudley), about		1
Pins and Pennyearth, ironstone measure, from	7 to	30
Intermediate measures, containing the sandstone known as the Thick coal rock	38 to	157
Broad earth, catch earth, and batt, containing the Ten-ft. and Backstone ironstone in the Pensnett district	6 to	14
THICK COAL.—Roofs coal or top floor; Top Slipper, or Spires, or Spin coal (these two form the Flying reed when separate from the coals below); Jays or White coal; Lambs, or Floors, or Fine Floors coal (these two are often either mentioned together under the name of White coal, or else the lower one is absent); Tow (tough) or Heath coal; Benches coal (this bed is but rarely mentioned); Brassils or Corns coal; Foot coal, or Bottom Slipper, or Fine coal; John coal, or Silps, or Veins coal; Stone or Long coal; Patchells coal (sometimes absent or not mentioned); Sawyer or Springs coal; Slipper coal; Bottom Benches, or Omfray (Humphrey), or Red, or Kid (Kick?), or Holers coal, about		30
Poundfill ball, Blacktery, and Whitery, containing the Gralus ironstone, and sometimes the Whitery ironstone, from	2 to	8
Gubbin ironstone measures, sometimes called the Little, or Top, or Thick coal gubbin, sometimes the Black ironstone	2 to	8
Table batt and intermediate measures	2 to	28
Heathen coal, about		3
Intermediate measures (sometimes wanting), from	0 to	43
Rubble, or Lower Heathen coal, sometimes, when the measures above are wanting, forming the bottom part of the Heathen coal, sometimes itself wanting, when the measures above and below seem to be both present, from	2 to	4
Intermediate measures, containing at Bentley the ironstone known as the Lambstone and Brownstone, from	10 to	33
New Mine, or White ironstone, from	2 to	10
Measures containing the Penuystone ironstone, called also Bluestone or Cakes, from	10 to	25
Sulphur coal	2 to	9
Intermediate measures	3 to	99
New Mine coal	2 to	11
Measures containing the fire-clay balls ironstone occasionally	2 to	40
Fire-clay, coal, and partings	1 to	14
Intermediate measures	2 to	10
Getting Rock ironstone (occasional)	4 to	5
Poor Robin ironstone measures	3 to	5
Intermediate measures, sometimes wanting	0 to	9
Rough Hills white ironstone (occasionally)	2 to	19
Bottom coal	3 to	12
Intermediate measures	5 to	30
Gubbin and Balls ironstone, sometimes called the Great or Bottom Gubbin	3 to	10
Intermediate measures	18 to	50
Singing or Mealy Grey coal (occasional)	2 to	4
Intermediate measures	16 to	50
Blue Flats ironstone	2 to	9
Intermediate measures	10 to	14
Silver Threads ironstone	4 to	7
Intermediate measures	6 to	15
Diamonds ironstone	2 to	3
Lowest measures, maximum thickness known below the Diamonds ironstone, about		50

UTILISING ALKALI BI-PRODUCTS.—In practising the invention of Mr. T. ROWAN, of Glasgow, hydrochloric-acid is added to alkali waste, and causes the separation of sulphuretted hydrogen; or the sulphuretted hydrogen may be separated by treating the alkali waste with steam. The sulphuretted hydrogen is passed through manganese chloride, and manganese sulphide is precipitated in consequence. The manganese sulphide is roasted to drive off sulphurous acid, and manganese oxide remains, suitable for re-use. Or the sulphuretted hydrogen may be passed through solutions of copper, or be used for precipitating other metals as sulphides, in order to utilise the sulphur by roasting and converting into sulphuric acid.

IMPROVEMENTS IN TRAMWAYS.—The improvements in tramways and light permanent way of railways invented by Messrs. Dowson, of Great Queen-street, Westminster, include rails of special forms and suitable chains of special forms, the rails of some of them specially having a deep rib, and in some cases a bulb or flange at bottom to afford strength to obviate necessity for longitudinal sleepers. Lip or guard to groove of rail in one piece with rail or joined on. Rails with groove on upper face and rib beneath in combination with wooden sleeper specially prepared to receive them. Rails, with arched or spreading base to bed on earth without sleeper. Girder like section, but with groove in upper member to receive separate head or rail. Supporting, suspending, or fixing in the chairs the improved or other rails, by timber or iron blocks, or wedges. Rails and chairs thus—rail in two parts, one the rail proper, the other a guard rail assisting to hold in the former and completing groove, and the chair specially formed to receive both, which are kept apart and secured in chair by iron wedge. Cast-iron box shaped chairs (bedded in concrete block) with wrought iron plates inclined outwards held on edge, and the rail being supported by timber wedge blocks between rail and plates. Knee plates as a chair fixed to transverse timber sleeper. Chairs or sleepers of thin wrought-iron, bent to shape of irregular triangular box, with arched base and sometimes stiffened with transverse tie rod, the box to be filled with earth to prevent collapsing, the rail to be suspended on two shoulders formed by the bending of the plate. Angle iron or flat or shouldered curb of iron fixed or applied to sleeper or to rail, to form part of or complete the groove for wheel of carriage and to protect the edges of stones or road-way. Particular applications of diagonally cut and other longitudinal timber sleepers under rail. Concrete applied as a base for rail either in blocks or in a continuous mass, with elastic packing interposed, the form and fitting allowing rail to be removed without disturbing the paving. Strips of asphalte applied to make good the space between rail and paving stones. Staffordshire blue bricks applied for paving between or at the sides of the rails. Combinations of any of the above improvements or parts of them.

DIFFERENTIAL CRANK.—The invention of Mr. G. H. BABCOCK, M.E., of New York, consists in communicating by means of a single eccentric or crank a varying motion reciprocating to parts of machinery. He employs an eccentric or crank fixed to the shaft in a plane with the main crank of an engine, or in such a position that it will pass its dead centres coincidently with the centres of the crank. One side of the strap of this eccentric is compelled to vibrate in a right line by means of a slide, the other side consequently describes an irregular oval figure. Another part of his invention consists in giving to the several governing dimensions of the above described valve gear a proportion by which the effect of the angularity of the connecting rod on the position of the piston in different parts of the stroke is compensated for. Another part of his invention consists in the combination of a parallel motion with the aforesaid link, by which he causes it to oscillate in parallel lines and vary its inclination. Another part of the invention consists in giving to the eccentric a differential velocity; he accomplishes this object by means of a differential crank motion or by eccentric gear wheels. The eccentric or crank may have its centre shifted across the plane of rotation. Another part of the invention consists in the use of a connecting rod of brasses, which allow of oscillation in the plane of the rod, in combination with a cross-head, which will permit a partial rotation of the rod upon its own axis. Another part of the invention consists in the combination of a connecting rod with spherical self-adjusting bearings. Also in the combination with self-adjusting bearings of an eccentric forming a portion of a sphere, and a corresponding eccentric strap.

Royal School of Mines, Jermyn Street.

[FROM NOTES BY OUR OWN REPORTER.]

LECTURE X.—From the brief outline which I have given (said Mr. SMYTH) of the character of the irregular deposits in which ores are found to exist, you will have sufficiently seen how important a matter it is to be able to come to a conclusion whether the ore we are seeking to obtain lies in a regular lode or in one of these irregular repositories. This is important for the twofold purposes of deciding upon the mode of present working, or of that in the future, and also to avoid litigation. It is equally desirable to form a true judgment of the geological character of the lode or deposit to be worked; because the important conclusions I have mentioned may be greatly facilitated by a geological knowledge of the formation in which these deposits occur. You will be prepared to expect these deposits in the limestone formation more than any other, and you are aware that when divided by joints and channelled out by water, that sort of action enlarges these joints and produces hollows of an irregular shape, forming a sort of *nidus* for metallic and other deposits, but the very circumstances of the case show that it is likely they will take many forms and put on appearances of a most deceptive character, and we may when expecting to find ore come only upon silt. In the district of the White Pine, which has attracted so much attention for its silver obtained from deposits which occur in limestone, there were no fewer than 250 independent claims or locations in a space at the surface of only 800 square yards, in each of which the workings were designed for the purpose of dealing with regular lodes or "ledges" as they are there termed. This, of necessity, led to a great deal of uncertainty, and in some of the reports published there appears to be not only a great conflict of interests but of statements as to facts, and as to the probabilities of the metallic deposit being merely basin-shaped, or penetrating into the adjacent rocks. In the case of the hematite deposits in the North of England, nothing is more important than a knowledge of these facts. Of course the true state of the matter is now pretty well understood, but there have been many cases in which iron ore has been met with at or near the surface, and has been found for a considerable distance to be a massive deposit; and then came the question whether it was only that or a gigantic lode. It need hardly be pointed out that, except at the commencement, the workings would be widely different, and therefore great precautions are necessary to prevent mistakes, to which end we should make ourselves as familiar as possible with the forms in which irregular deposits occur in particular districts. In the North of England it is usual to assist the researches made by means of boring rods, and especially when they have a great thickness of alluvial matter to deal with; and when a deposit is found to be merely a superficial bed, the miners say that it dishes out. On the other hand, these very deposits will put on more or less the appearances of a lode; as, for instance, when they have a mass of iron ore between two regular walls, and which miners from a lode district would be almost sure to mistake for a regular lode, and would be surprised to find in most cases that the ore entirely ceases within a moderate distance. It is, in fact, the general opinion that ore will only be found in the limestone, and that when the deposit comes to the shale beneath no trace of it beyond will be found. Not very dissimilar to these may be considered the great masses of ore of Scandinavia, which are found in Sweden and Norway, in deposits which assume the character of lodes. These deposits run like oblique lodes from 20 ft. to 30 ft. wide, and sometimes to great depths, and then terminate completely, as I have myself seen at Arendale (and the same thing occurs at Dannemora). The deposits after yielding a great quantity of excellent magnetic iron ore suddenly closes in and comes to an end in the surrounding rocks, and no trace whatever of anything like ore is to be found. The ores so obtained are of a lenticular character, and come to a point at their extremity in length, and in the depth they end with some sort of wedging out. They are placed amidst schists of extreme hardness, hornblende schist and mica schist alternating. When the miners come to a place where garnets begin to appear in the hornblende, they then find these lenticular deposits, which consist, as I have said, of magnificent magnetic iron ore from 10 ft. to 40 ft. broad, and holding down to a great depth, and, in fact, are worked down to 130 fms. Similar circumstances attach to the Fahlun Copper Mine, remarkable for having been worked for centuries to great depths, but having features widely different from those of ordinary lodes. There, too, they have mica and quartz ore schists, hornstone, and the like, of extreme hardness. At the present moment certain deposits of silver ore in the United States, and the hematite iron of the North of England, are two of the most remarkable cases known to have occurred, and of course in dealing with districts of this sort, we must endeavour to find out what has already been actually observed, and from that conclude what is likely to be the case with respect to deposits of which we can only see a small portion at the surface. As to modes of working these irregular deposits, they will vary very much. In some cases they are very simple, being merely digging out; in others, where they go down to great depths, as when the deposits approximate in character to true lodes, they must be treated like the latter. Generally speaking, a careful search at the surface will give a clue to some sort of difference.

We now come to the searching for or "prospecting" for lodes, and here, if we had time to go into it, we should find much interesting historical matter connected with the first discovery of mines, oftentimes of a curious character, and show in a great many cases that the discoverers were indebted for their good fortune entirely to accident, and in other cases to well-founded searching. In California and Australia, in these later times, where thousands of people have been let loose, as it were, to search for minerals, and where a great number of lodes come up to the surface, it is natural that they should be discovered by casual exploration. When we are looking for stratified minerals, such as coal, ironstone, rock salt, and so on, we must look to the conclusions arrived at by geology. That science teaches us in what localities we should seek for beds of this kind, and the principles of parallelism known to exist in the stratified series will lead us to pass from one portion of the country to another with a comparative certainty of making out the particular position of the beds. This only refers to the search for stratified minerals; and mistakes are sometimes made from forgetfulness that results may occur from causes analogous in character but not precisely of the same sort. Thus, it is loosely suggested that coal is to be met with wherever limestone and ironstone are found in the same district combined. No doubt in some coal fields this association is not uncommon, but that is no reason why it should always be the case, as in fact it frequently is not. Then it is said that a cold clay country is indicative of coal, but there could be no greater mistake than to take that as a rule, and to generalise on that characteristic because it agrees with some coal fields. Then, again, where the springs produce red hydrous oxide of iron is a sure sign, but that almost invariably arises from the decomposition of iron pyrites when it is based upon clay too dense to allow water to pass through, and thus gives rise to appearances of this sort when the water comes to the surface. Geologists, chemists, and mineralogists will see that these appearances may arise without their having anything to do with coal. Wherever, in fact, iron pyrites are decomposed, ochreous matter is formed without reference to coal. Another supposed infallible sign is the emanation of carburetted hydrogen at the surface. This is often met with in digging cellars, and there have been elsewhere great effusions of gas at the surface of the ground, undoubtedly derived from coal seams. But emanations of this kind come from other formations, as, for instance, in salt mines; and years ago a salt mine was lighted with gas that came off in this way.

We will now pass from the stratified formations, and come more particularly to the search for metalliferous deposits, and I will divide the subject into three heads:—first, to determine the back or outcrop of lodes already known; secondly, the discovery of branches or parallel lodes, of which something is already known; and lastly, the exploration of totally new ground. In the two first certain elements are given in existing works, and we have to find out the rest. If lodes have been worked for some time, and we wish to find the direction in which they continue is our first task. If we look at the geological map of Cornwall and Devon on the wall, we shall see how small a portion of the surface is occupied by veins which run in groups, although these groups have given rise to extensive workings, as, for instance, at Carn Brea, about Caradon, and at Redruth. Where a lode has already been worked, and is known to be enclosed on both sides with the same kind of rock, we shall have first to make out its strike and dip. With stratified beds there is no difficulty in finding out what is above and below the bed of useful mineral; but still the first and principal task is to take the strike and dip as accurately as possible, or, at least, their average if we find the line to be very variable; and the more a bed or lode deviates from the perpendicular the more trouble it will give us in following it across the country. The intervention of a valley often produces difficulties which nothing but a careful attention to the parallelism of the beds will overcome, and so we might, after such an interruption, look for the lode in the wrong place, in consequence of the apparent deviation produced by the ground being hollowed out by surface action or by actual depression. When, however, we come to the lode again on the opposite hill, we shall, probably, be able to see the whole nature and details of the case. Generally, however, it is a matter of solid geometry. The more vertical the lode is the more simple is the problem, and a deviation of 10° or 20° from the perpendicular will make but little difference, as it will then present an approximately straight line, and when there are groups of lodes, what is true of one is nearly always true of another. A different kind of problem suggests itself sometimes. When we are already working underground it may be desirable to know where the outcrop exists; to ascertain this we must accurately determine the angle of the lode with regard to the surface, and then it becomes again a simple geometrical calculation. Supposing we have a good observation of the inclination of the strike, and the lode is covered by not more than 6 ft. or 8 ft. of alluvial cover, we dig a trench across the line of strike, at a well-selected point, and strip the rock bare. If it have 15 ft. or 20 ft., we put down little pits or shafts, and drive from one to the other. If we have the case of a lode running between two different classes of rock, it is obviously more easy to deal with them than if we have a similar rock on both sides; as, for instance, if we have a granite rock on one side and clay-slate on the other, the space to be reached will be greatly narrowed. One or two points may be mentioned as important in following the lode, or even a stratified deposit, over the surface of the country. Take, for instance, a country like the gold districts of Victoria, where, as at Ballarat, there is a considerable development of granite rock along with clay-slate, but where it is also overlaid with alluvial deposits of great thickness associated with bands of lava. In other places these stratified alluvial deposits are overlaid by rocks, and the question arises—and a very important one it is—whether the workings carried on here successfully for a length of time should be extended below this rock. It was pointed out that there might have been lava poured over the surface of the country after and upon the alluvial deposits; and this has proved to be the case, thereby greatly enlarging the extent of auriferous area. In Derbyshire the magnesian limestone lies unconformably on the coal measures, being a super-stratification of a newer formation; but the case might be entirely different with a rock of a different character. A study, then, of the age and character of the local rocks is of great importance.

Before we pass on to the subject of exploring in fresh ground it is important to say a few words as to the examination of districts where the old mines have been a frequent source of the satisfactory investment of capital, although in other instances they have led to expenses greater than might have been expected and to disappointment. If we look in any mining country we shall find also that the majority have been abandoned, and shall generally always find a great number of mines have been abandoned from causes which a change of times would have prevented. Supposing a mine to be abandoned on account of the insufficiency of the pumping machinery, and the difficulty of obtaining better or more advantages in those respects, which would enable us to re-open such a mine. Again, the shafts may have been sunk on a part of the lode which was small and poor, or worked to such a point, and so it was abandoned on

account of poverty, the chance in such a case of the lode recovering itself not being sufficient.

In parts of France, Spain, Sardinia, and Greece, there are mines worked by the Greeks, Romans, and others dating back to the Middle Ages, and it is, therefore, desirable to become acquainted with the circumstances under which they were abandoned. When a mine is abandoned the water in it rises to the level of the adit, or the natural outflow, and it is a serious matter to empty it again, and then open new ground. It is difficult, also, to know what was the condition of even more recently abandoned mines when that course was taken. When we can get satisfactory documents as to the extension of the workings in former times, such documents would be precious indeed; but generally we are left to traditions and oral statements, handed down, perhaps, for several generations, and then we are, indeed, upon treacherous ground. People sometimes on such authority point out mines where on exploration there never were any. A series of depressions on the limestone formation are held to be the original shafts, as it is obvious that when the shafts fall in the ground will present the appearances of a crater-shaped hole, but after all they may be nothing but a series of cavernous hollows in the limestone, like those common where the limestone comes upon another stratum, known in this county by the term "swallow holes."

But if it be not a limestone district, and if we find any traces at the sides of these hollows of rubbish from below, there will be good reason to believe that it is a line of shafts, and particularly if they should be discovered to run in the line of the lodes of the district. When such appearances cross each other at right angles it must not be concluded that there are two lodes crossing each other, because one will, probably, be found to have been made to assist in the construction of an adit level to unwater the right line. We must then carefully examine the heaps, and find which portions were the last extracted from below, and which the next, and we may here find evidence whether the workings were abandoned on account of the miners being mastered by the water, and if there should be a large outflow now that would be important confirmatory evidence, or if there should be valuable ore or minerals left in the rubbish we may safely conclude that there were other causes for the abandonment of the mines than the overwhelming presence of water—possibly war or political changes. All these circumstances must be carefully considered, for the purpose of coming to a right conclusion as to the quantity of capital needed for the re-opening of such a mine, and as to whether it will be likely to yield such results as will make it worth working.

At the present day steam-power, improved machinery, and systems of working, and the great facilities for obtaining capital, have led to the resumption of many old mines of this sort with great prospects of success. There is, however, no greater mistake ever committed by shareholders than going to the expense of unwatering a mine, with the expectation of coming to a deposit of ore worth working, on the faith of old plans, or, still worse, of tradition, or even the evidence of eye-witnesses. It is curious how eye-witnesses deceive themselves as to what they saw when last in the mine. Without any intention to deceive they have fixed the eye of their memory upon some one favourable indication, and all that which was hostile has faded away from that same memory. In adventures of this kind, therefore, it is not only necessary to have capital for the erection and working of engines, but with such a surplus as will enable the miners to sink and drive into new ground, so as to open it to a considerable extent before it can be expected there will be such returns as will enable the mine to pay a proper amount of profit to the shareholders.

LECTURE XI.—From what has been said (continued Mr. SMYTH) you will be prepared to learn that when dealing with stratified deposits it is the object of the miner to follow his search where the ground is free from dislocation; while, on the other hand, those who are seeking for lodes endeavour to carry on their operations in ground more or less dislocated and disturbed, although there are cases in which dislocations exist to a great extent, and yet are unfavourable to the richness of the deposits in them. The older writers had a good deal to say about the geographical distribution of ores, but the great discoveries of the last 40 years have shown that most of their ideas may be scattered to the winds, and it seems almost impossible to form an opinion as to any particular order in which metallic substances are spread over the surface of the globe. It was once suggested that fossil fuel was only to be found in moderately high latitudes, but modern discoveries have proved that there is coal in all latitudes. Again, it was thought when the chief gold supply was stream gold from Africa, that the precious metals and gems were only to be obtained near the equator, but now the area over which these metals have been successfully sought for is greatly extended we see that these dogmas can no longer be maintained. A great preference is sometimes given for lodes having a particular direction and inclination, and we have seen in particular districts this view holds good, as one class of metals will be found in the lodes which run in a particular direction, and another class of metals in lodes which run in a different direction. Curious fancies were suggested by the older authors in respect to these matters. For instance they asserted, and that, too, as the result of observation in various districts, that there is a decided tendency with particular rocks to be connected with the occurrence of particular minerals, and thus one side of a lode was imagined to be more productive near these rocks than the farther side. Others, again, have pointed out that when lodes dip with the hill, or in the same direction, they are likely to be productive, and if the contrary, that they are likely to be poor. There may be reasons for this in the rocks themselves, but, nevertheless, a preference is always given by miners to one side of a range of hills, and to a particular dip, all other circumstances being the same.

A mining engineer, named Burn, wrote a book some years ago based upon actual observation, in which he found this was the case, and he gives a great number of cases in which dipping with the hill side was connected with riches, and other cases in which dipping against the hill was observed to have a contrary effect. Working miners say that when the lode dips towards the hill the weight of the hill is too much for it, and "squeezes out" the ores. In other districts it is notably the case that a moderate amount of inclination under high ground is not objected to; and it is even said it will become richer as the lode gets more ground upon it—that is, if the lode be shallow it is not expected to do well, whereas if it has a certain amount of cover it is expected to do better. Instances in favour of this view may be quoted from a great number of localities. At Schemnitz, when the lode falls away from the main hill it becomes poorer; and in our Cornish districts, where we have the granite and the killas, the good lodes are said to dip with the granite. At Fresnillo, in the province of Zacatecas, Mexico, Mr. Buchan made observations of the same kind.

Thus, amongst other statements as to the discovery of veins, it has long been asserted that along the backs of lodes the snow melts sooner, and the hoar frost disappears more quickly, than on the country around; also the grass withers sooner, and so marks out lines which show where the lode is. That this statement may have been exaggerated is not unlikely, but there are some elements of truth in it. If the lode comes near the surface, as in Cardiganshire, it will shew distinctly against the grass on both sides; but where the containing rocks be harder the back of the lode is eroded, and makes a channel for water, or the water lies there, and produces a different kind or a more luxuriant vegetation than the walls would do. The run of the lodes in Cardiganshire is easily seen at the surface in this manner. It is also said that particular plants or trees grow upon the outcrop of particular bands of mineral, as well as on the outcrop of lodes; and the mere fact of coal being overlaid by beds of clay when otherwise there is little alluvial cover may allow full play to circumstances of this kind. Even the sense of smell may be brought into service. In the county of Wicklow, in some places in Cornwall and in Wales, where large quantities of iron pyrites are present, and when decomposition is going on, the peculiar odour of sulphuric acid cannot help but be noticed by anyone passing such a place on a fine sunny day. Another belief was formerly common, that luminous appearances or lambent flames were seen on warm summer nights over lodes, and not over other mineral deposits. You will find statements of this kind in Pryce's "Mineralogy," as well as in the travels of Van Buren, a famous mineralogist of the last century; and even now a-days, from time to time in the *Mining Journal*, you will see a number of cases cited in which appearances like flame have, in certain states of the weather, been observed over lodes. I have never seen anything of the sort myself, but I have had the fact from persons whose testimony in other matters would not be doubted. Amongst others, the late Davies Gilbert, President of the Royal Society, used to state that he had seen something of the sort himself. It is on record that the Wheal Buller lode was discovered by this means, but the phenomenon is no longer to be seen, as the miners say that when a lode is worked the flames disappear. It is, however, a curious coincidence that the same story should be repeated in so many different districts. Lambent lights are not heard of in Cornwall only, but in many parts of Europe, particularly in Transylvania, where such appearances in Nagybánya led to the taking up of a mine there which proved rich in gold and tellurium.

Another curious practice of the olden miners—the use of the dowsing or divining-rod—is still believed in by some persons. This was introduced in the 11th century in Germany, in the Freiberg district, and in the 13th century was generally believed in; since which period its reputation gradually declined. Amongst the old writers Paracelsus admitted its use, but recommended caution; while Basil Valentin denounced it as "uncertain, doubtful, and unlawful"—the unlawfulness being an allusion to its supposed powers originating from under-ground influences much deeper than any of our mines. (A laugh.) In 1845, M. Chevreuil, a well known member of the French Institute, published a work in which he carefully examined all the statements put forward on the subject of the divining-rod, and he came to the conclusion that the motion of the divining-rod, in the hands of honest and believing persons, is produced by an action of which they are not conscious at the time. The divining-rod is a forked twig of hazel or apple, or some other fruit-bearing tree. The operator takes the extremities or the two ends of the fork one in each hand, and then twisting it backwards brings the handle of the fork into an upright position, where it is held in what I may term an unstable equilibrium. He then passes over the ground to be tried; and the theory is that if he passes over a lode the handle will, in spite of all his efforts to the contrary, turn down and point to the spot. There are persons in Cornwall at this day who would stake money on the result; and it is alleged that so closely does it indicate the vein that it will give within very small limits the width of the lode. I have myself seen a shaft which was put down at a particular place, solely because the divining-rod had indicated it. Mr. Cookworthy, of Plymouth, a chemist of eminence in his time, was a firm believer in this art; and no doubt it has been taken up by many persons without any intention to deceive, and who may themselves have been deceived by a mechanical action in the rod, arising from the peculiar way in which it is held Moreover, in Cornwall you cannot go far without striking on or near a lode. A great many experiments may be made by this extremely economical process of search by those who believe in it; and I have had pointed out to me in the South of France two admirable mines of silver discovered by its means. It is also said that springs of water are discovered in this way; and not many years ago a French ecclesiastic gained considerable sums of money by discovering springs. In the Channel Islands the belief is widely prevalent, as it is also in the adjacent parts of France. Some of the later discoveries in Cornwall are stated to have been made in this way; but I agree with the advice given by that fine old writer, "Agricola," that it is better to be skilful in other less empiric means, and by applying a knowledge of geology and mineralogy to the work of search being able to give a right judgment as to the true nature of lodes and their locality, without resorting to this questionable art.

Amongst the best methods of searching for lodes is that called "shoding," that is to say looking for stones in the beds of the streams, the character of which shows that they have been separated from a lode adjacent. On this head some good advice is given by Dr. Pryce, who says in his book that "it is much to be lamented that the *science of shoding* has been so much lost sight of in the present age." This science, however, has been much fostered in the mining districts of the new world, and some of the most successful mines in California, Australia, and America have been discovered by it. In a new country, then, the first thing to be done is to take a general survey of the country, looking at the cliffs, and wherever the rocks are exposed, as to the general structure of the district. We must next determine what minerals may be expected to be met with in veins.

If it be a district where there is much detrital matter carried down by the streams, as, for instance, if it be a clay-slate district, we must examine the beds of the streams, and if we find fragments of fluor-spar, sulphate of baryta, or perhaps fragments of the ores themselves, we may safely come to the conclusion that metallic minerals are not far off. At least, that is, if the shode stones are large and angular, for if they be smoother and smaller they will have travelled further. If these stones are found not only in the streams, but in the dry ground adjacent, Dr. Pryce gives the following rule:—"If the shodes be found in vegetable soil the lode is not at hand, but if they are deep, of a good size, and angular, the lode is not far off." The streams must then be followed upwards, and if any branch runs into it examination must be made, whether the stones come down that branch or from a spot yet higher up. Sometimes indications of gold or tin are found by washing or panning. When the neighbourhood of the lode is reached, as indicated by the disappearance of the shode stones, it may not then be easily discernable, as it may be covered up with soil, gravel, or other material, and then it will be necessary to make use of the process called "costeaning." If the run of the vein is supposed to be east and west then the costeaning trenches should be cut north and south, and if the lode be not then found they may be cut in other directions, until in this way the whole of a considerable space is thoroughly searched, and the vein is intersected. A species of costeaning called "hushing" is practised in districts where the surface has but little agricultural value. A dam is made, and the rains collected until there is a good head of water, this is then let out by a trench in the direction required, and the velocity of the escaping stream washes out a vast quantity of material, and often lays bare the hard rock. This is examined, and the material brought down is also carefully searched for shode stones. Veins are not unfrequently discovered in this way. The system of hushing is carried out on a large scale and in great perfection in California and Australia, where it is called hydraulic mining. This is extremely useful to sweep away the cover of the rocks, so as to allow the latter to be thoroughly examined. I may mention that in some districts shode stones are often found of a quality and in quantities sufficient to make them worth while to collect, and lads often employ their leisure in this work. [The lecturer then by means of diagrams illustrated the results of gravitation upon shode stones, and the positions in which, in reference to the lodes from which they were supposed to come, they might occupy.

THE FORMATION OF METALLIC VEINS, LODES, &c.

THE LECTURES AT THE ROYAL SCHOOL OF MINES.

TO THE EDITOR OF THE MINING JOURNAL.

SIR,—With great attention and interest I read, in the Supplement to the Journal of Dec. 16, Mr. Warington Smyth's Lectures on Mining, in which is given a full, most lucid, and truthful description of metallic lodes, and of the phenomena therewith connected. There are, however, but few rules which admit of no exception. In speaking of gossans the learned lecturer says:—"I may mention that, in Cornwall, there is no chance of meeting with copper ore at less than 30 fms. or 40 fms. deep." It is true that sometimes it happens that twice or thrice this depth is obtained before ore of any appreciable value is met with, but such is not always the case. The writer has seen courses of black and grey copper ore reach or pontinue, as it were, almost up to the fern roots. He knew a man who earned 1100*l.* in a tribute pitch which he had taken in the high backs in Poldory, and so near to the surface did his operations reach that he sank a grass shaft on them, and through which, with a tackle-windlass, extracted the whole of his ore.

Operations, I remember, in Penstruthal, which during its short existence was one of the richest copper mines ever known in Cornwall, and was the only one for the ores of which a special ticketing or sale was held, were commenced in an open chasm or cutting made by the ancients on the back of the lode, say from 7 to 8 fms. deep; and so soon after the commencement of operations did the Penstruthal people meet with riches that the miners could be seen, by the light of day, from the surface, working on a course of grey ore. See also the abandoned surface openings in St. Agnes, whence such vast quantities of copper ore were extracted. Mr. Smyth, in his excellent description of gossans, remarked that they are "sometimes found to extend to considerable depths," and instanced Ting Tang, an old tin mine in West Cornwall, where they were found at the depth of from 150 to 160 fms., and it is stated that at the lecture was exhibited a piece taken from the depth of 150 fms. in Sharp Tor Mine, and in which copper ore was perceptible. Now, in the back of the 110 fm. level, below the adit in the above-named mine (Ting Tang) the writer saw not only a piece of gossan in which copper ore was perceptible, but a course of rich gossan ore (giving it the mining term) which was worked, if he rightly remembered, at 2*s.* in 1*l.*

It would appear that Mr. Smyth was mistaken in calling Ting Tang a tin mine. It was a copper mine, with which the writer was well acquainted during the whole of the time in which it was worked, and he believes that it never sold even a pound of tin. Had it been a tin mine, was it likely that such a mass of gossan would have existed at the 110?

HOW WERE METALLIC VEINS FORMED?—Notwithstanding the speculations, writings, and discussions which have been bestowed by the *savans* during the last forty years on this subject, the vexed question does not, as yet, appear to have been settled: the general opinion, however, of those who pretend to know all about it seems to be that metallic lodes or veins were fissures or chasms—a vacuity—which by some kind of action, either igneous or aqueous, became filled. It would appear that the latter has of late become the favourite theory; that the metallic substance, or ore, which we find in the veins, was held in solution, and that by the percolation of the water, which held it, through the surrounding or encasing rock, was brought in and filled up the chasm. Some seem to say that the percolating action was upwards, others say that it was downwards, but I do not see that either corresponds exactly with what we find in Nature. The upward motion would seem to oppose the law of hydraulics, unless it were on the Artesian principle, but as we frequently find the largest and richest lodes of ore on the highest ground, the idea of this principle cannot be entertained. Again, we frequently find a lode rich in ore standing exposed many feet above the surrounding surface; this more frequently occurs in mountainous districts—*e.g.*, a few months ago the writer was in Wales, where he saw the miners blasting down the back of a lode, and working on a stage which they had hung to pegs more than 20 feet above the surface. This was on a mountain, and at least 100 fms. above its base. What kind of percolating action, I should like to learn, deposited the ore in this reef, this elevated lode?

But supposing that the ores found in veins were deposited there by the action of water, and drawn by it from the surrounding strata, are those strata supposed to have contained the salts—the essence—of different kinds of metals in the same place and at the same time? And, if so, by what power or agency was the water directed in its operation so as to conduct them with such amazing skill and regularity?—for it is true, as Mr. Smyth observes, that the lodes in Cornwall generally produce tin immediately below the surface, and for this metal were worked to a considerable depth. Thence succeeded copper ore, for (say) 150 or 200 fms. deeper, and the copper ore in turn has been succeeded by tin ore. Each layer of the ores is perfectly distinct—the tin ore has no admixture of copper, neither has the copper ore any admixture of tin.

Nay, this is not the only mode which Nature has adopted in making near neighbours of tin and copper ores. The writer in his youth saw, in Wheal Jewell, a lode which carried both tin and copper ores beside each other, and which were divided by a smooth facing, so that the one could be broken without the necessity of allowing one particle of it to mix with the other. The branch of tin ore was on the footwall. Certainly, there are indications which convince to a perfect certainty that copper lodes in certain places, where riches are, have been in a state of fusion; but I know of nothing to suggest the idea that ever metallic veins were once vacuums, which have been filled by the percolation of water. We sometimes find a rich copper lode encased in ground in which there is no stain or any other sign to suggest the idea that ever a solution of copper had been there. On the other hand, we have a lode which is too poor to pay for being wrought, but where there is a liberal supply of native copper scattered throughout the adjacent rocks—lodes formed by the filtration of water. On some of the mountains of Chili the mines of both silver and copper, with which the writer was for ten years connected, and which are some of the richest mines in the world, have been worked to a depth almost equal to that of our deepest Cornish mines, without there ever having been seen even a sign of water, either in or about them. Lodes, say the *savans*, must have been formed by aqueous action, by metallic salts held in solution, and which were carried in to fill a pre-existing fissure. If this be true, how can they explain the fact of the most delicious water issuing from a course of ore of upwards of 30 per cent. of copper? This I saw in Chili, and all that the miner had to do, when thirsty, was to open a hole in the ore that he was in the act of breaking, and stoop down and drink a water in which there was not the slightest tinge of anything cupreous or disagreeable. Again, if veins were formed by filtration, or by the metals held in solution, how are we to account for the poverty of some of the most regular and best defined lodes? Many there are of this description in which not a particle of ore was ever seen. Others there are which, by turn, are rich and poor. I cannot believe that metallic veins have been thus formed, for it appears to me that experience says—No.

Now, I shall not attempt to advance any opinion as to how or in what manner the fissures—if fissures they were—became filled, but only assume that they were fissures or cavities; but still Nature tells me to be incredulous even in this. I see two large metallic veins inclining towards each other, and which will in depth meet or form a junction, as shown in the annexed diagram. Then, I ask, supposing the blank which is shown on each side of the figure, *A B C*, to have been hollows which have been filled by filtration, what sustained the fragment of the world—the mass of earth—shown by the figure? Did it remain in a state of quiescence, hanging upon nothing, but suspended in air, waiting for the filtration to accomplish its work of filling up the chasms? I conceive not, for before the miners can venture to remove the ore from under the point, *C*, they have with strong timber to secure the superincumbent mass, and so to go on securing as the ore is taken away from below. This is called "taking up the point of the horse"—an operation which is attended with great danger, lest the rock should fall from above. I see no practical men indulge in speculations as to how metallic veins were formed, and believe that from daily occurrences they are convinced that it is a subject too abstruse for mortal ken. And would it not be well if those who bestow so much time and thought on this subject were to turn their attention to something which they are more likely to comprehend, and which probably would prove of greater public utility; and leave this as one of the "secret things which belongeth to the Lord our God," a part of whose creation are mineral veins, and which I believe were formed when he put forth his mighty power, and "spoke a world from nought."—*Dec.* 26.

JOHN LEAN.

COMPRESSED AIR AS A POWER FOR UNDERGROUND PURPOSES, &c.

SIR,—In reading the two letters which appeared in the Supplement to last week's Journal there appears a great discrepancy between the statements as to the capabilities of compressed air available, if I understand them right. Mr. Warburton states that, after having made careful calculations and experiments, the approximate amount of available power produced by the steam-engine only 27 per cent. reaches the air-engine underground; while Messrs. Firth and Hurd state that by means of their patented differential lever being attached to the air-compressing engine "3 lbs. of compressed air is obtained at an expenditure of 1 lb. of steam"—or, in other words, a 10-horse steam-engine, with the addition of a differential lever employed to compress air will give 30-horse power available underground.

I think there must be something wrong, the difference being so great. Mr. Warburton gives the method by which he arrives at his calculation—Joul's experiments on the mechanical equivalent of heat, 772 foot-pounds through 1 foot. If Messrs. Firth and Hurd have by their differential lever, or any other lever, reduced the cost of steam to such a minimum compressed air-engines must be economical, both for mining and all other purposes. J. M. R.

SELF-ACTING MINERAL DRESSING MACHINERY.

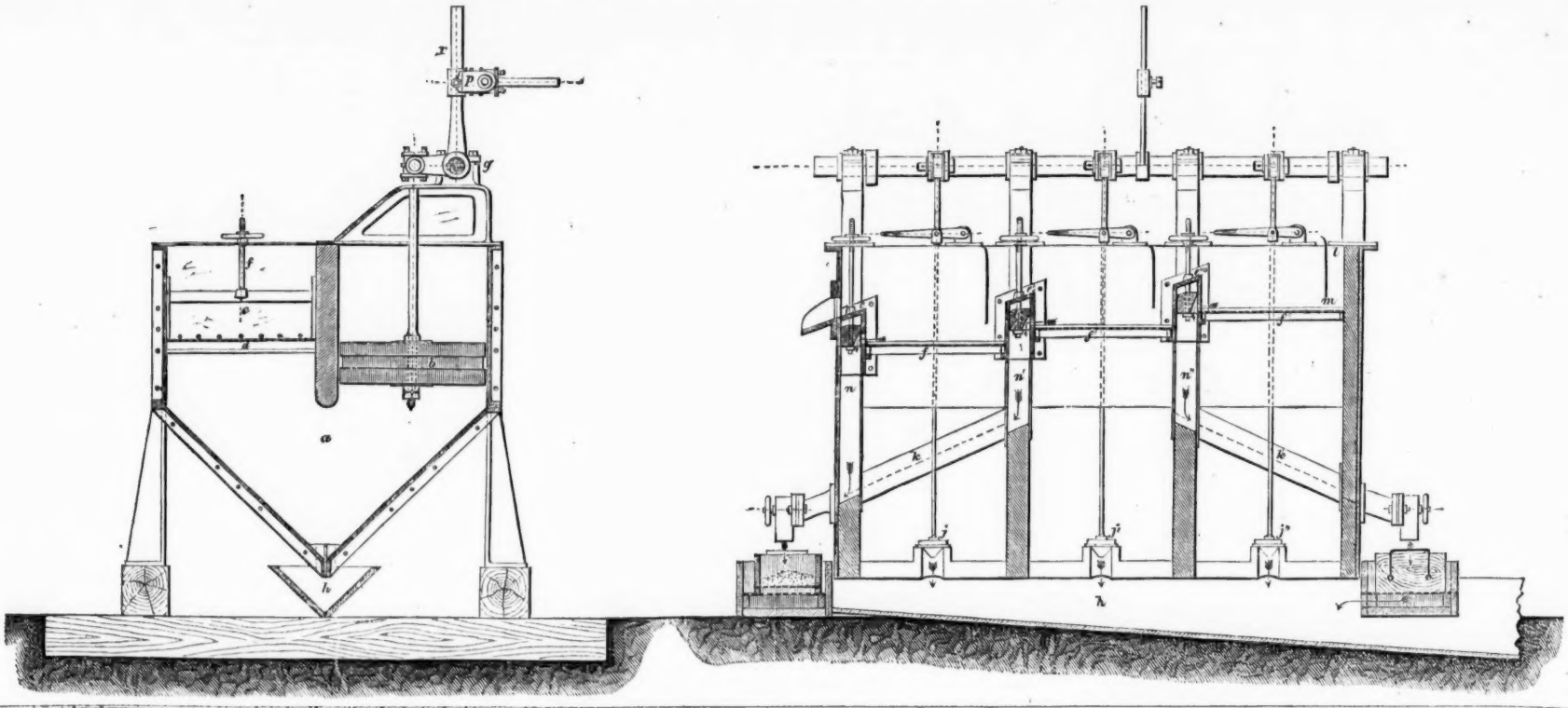
SIR,—Since my communication which appeared in the Supplement to the Journal of June 10, we have completed the newly-invented Crushing Mill, and by this time we have had several months trial of it. If it had been of an ordinary construction I would not have attempted to bring it before the public. I have seen many on the old plan, and many sets of stamp-heads in full work, but neither of them could do the amount of work performed by this one with double the power to keep them going. It is surprising what a small quantity of water will keep it working at such a rapid speed. It has two motions—one is revolving (as the ordinary), and the other is a horizontal motion. By this latter motion the face of the rollers are always kept even and smooth. We are crushing the raggings so fine with it that it passes through 9 holes to the inch, or 81 holes to the square inch. The stuff crushed runs direct into the classifiers, and from these into the jigging machinery. The slimes float in the water over into the slime floors. We have also remodelled our slime floors, and done away with the old system of catching the slime in slime pits.

And, with your kind permission, Mr. Editor, I will try to lay before our mining friends how simply and effectually this is now being done. On these floors the slime waters are delivered into No. 1 classifier, in the bottom of which there are a series of holes, and through the proper sized hole the weight of stuff and water are forcing out the heavier particles into a launder, which conveys it into No. 1 circular buddle, where it goes under the proper operation. A lighter and finer stuff flows over No. 1 classifier and into No. 2 classifier, which is a good deal larger than the first, and this classifier discharges the heavier slimes through a small hole in the bottom into No. 2 buddle. The lighter slimes again float over No. 2 classifier, and into No. 3 classifier. The heavier stuff, again, is forced out at the bottom and into trunks worked by revolving paddles. What water and stuff run over No. 3 classifier go into No. 4, which is as large as the other three put together. The stuff from this again goes into trunks, and the water running over No. 4 classifier is as clear from having any ore carried away with it as any water running from any dressing-floors in the Principality. All the slimes, in the way suggested, are delivered into the machinery without any person in attendance. The machinery is worked by a 6-feet diameter water-wheel. The cost of constructing the four classifiers is no more than it would cost to make two well made slime pits.

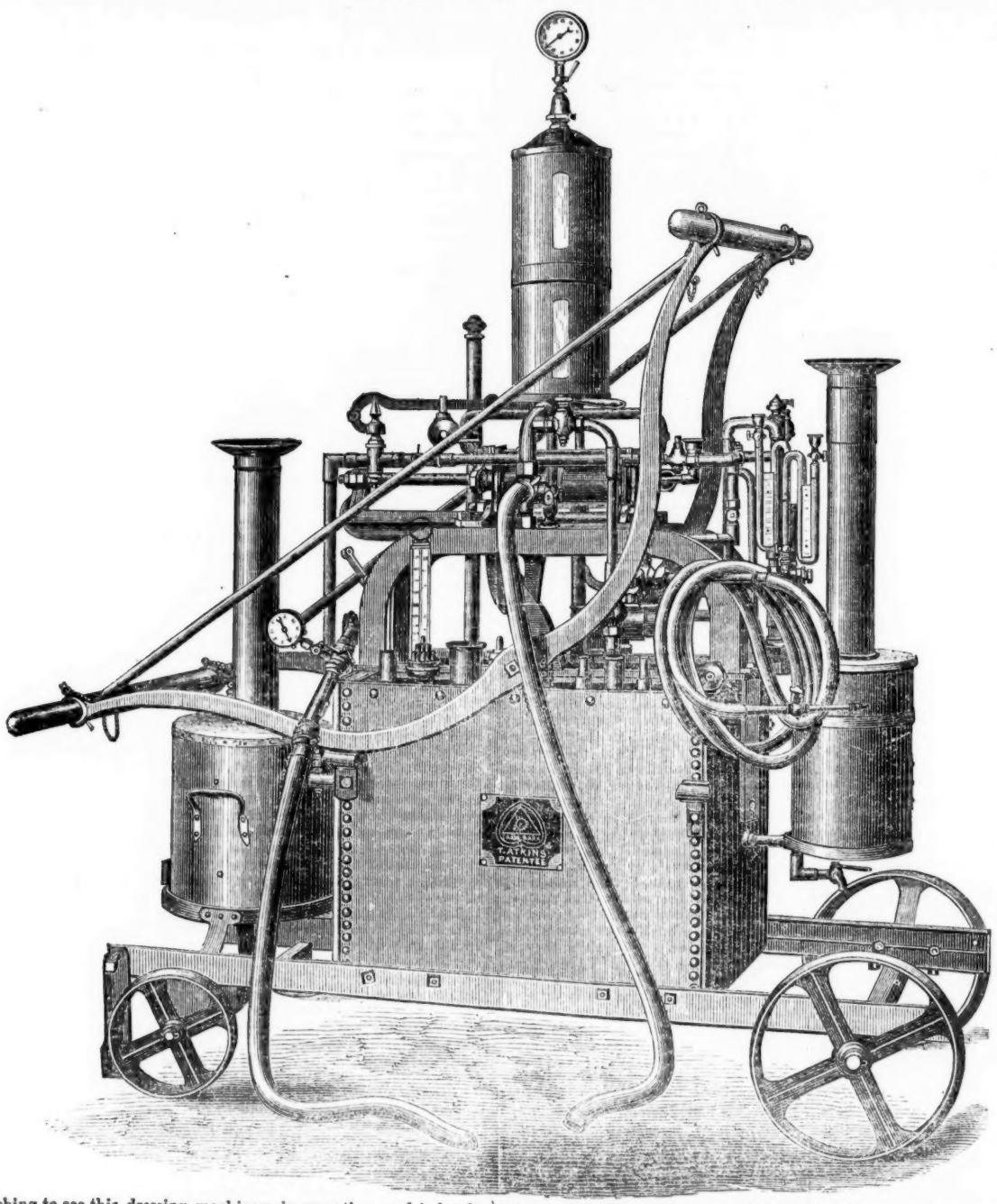
By these arrangements all labour and expense of slime dressing is almost saved. But that is not the only advantage of adopting the new system. The slimes are delivered into the machinery more regular than any person can do, be he ever so careful, and the quantity of water is unvaried, consequently the stuff is worked more regular and more effectually on the buddle. All practicals who have seen them in operation agree that they will take from 10 to 15 per cent. more ore from the stuff than any other mode of dressing machinery hitherto in practice. It is generally considered, and it is a fact, too, that the slime ore contains more silver than the rough does, and as we are having from 10 to 15 per cent. more fine ore, it follows that we are obtaining from 15 to 20 per cent. more silver also by this method of slime dressing.

No doubt the scheme will prove a great boon, especially to parties who have to deal with silver-lead ore. It is, no doubt, fresh in the minds of many of the readers of your esteemed Journal that engineers from England were in the habit of going over to Germany and elsewhere in order to see newly-invented machinery, trying their best to improve the system of dressing, and no doubt some good has been derived from their labours; but, strange to say, now-a-days mining gentlemen from Germany, Australia, South America, and, in fact, from all parts of mining countries, come to Wales with the sole object of seeing those in operation, and without an exception they have ordered whole sets to take out with or to be sent after them. My chief object in writing is to call the attention of mining captains and capitalists to a matter that, if this dressing system should be adopted, will save many mines from a wreck, and will add considerable value to the golden columns of the *Mining Journal*, besides no doubt being the means of re-starting many abandoned mines with better hopes of success than ever. Any gentleman or a party

ORE-DRESSING MACHINERY.



DESTRUCTION OF FIRE-DAMP, AND EXTINGUISHING FIRES.



wishing to see this dressing machinery in operation, and judge for themselves, will find every facility to do so at the Great Darren Mines, near Aberystwith.—*Dec.* 23. A. W.

ORE DRESSING MACHINERY—No. XVII.

THREE SIEVE COARSE SAND JIGGER.—The three-sieve jigger, Fig. 1, has been designed for the purpose of effecting a separation of lead and blende ore associated with carbonate of iron and other heavy minerals. The transverse section shows hutch (*a*), piston (*b*), bridge (*c*), regulating screw (*f*), rocking shaft and gear (*g*), and discharge launder (*h*). The longitudinal section exhibits three sieves (*f, f, f*), bridges (*c, c', c''*), enclosing ore regulators, discharging-valves (*j, j', j''*), ore pipes (*k k*) furnished with stop-valves, ore trays with perforated bottoms, and ore tray launders.

Sand, sized into suitable divisions, from two to ten millimetres in diameter, introduced at (*l*) passes under the slide (*m*), when it is progressed across the perforated plate to the first bridge, separated ore, flows into the receptacle (*n''*), sand and ore, carried over the bridge (*c''*) fall into the second sieve compartment, and after treatment passes to the third sieve division. From the second sieve receptacle (*n'*) mixed ore is obtained; from the third receptacle (*n*), a sand sparingly mixed with ore, and from the discharging shoot, waste sand. The stuff contained in the receptacles is from time to time drawn off into trays, fitted with plates perforated with holes of less diameter than the orey grains. All water passed through the several valves flows into the launder (*h*). The regulators are formed so as to allow of the passage of large or fine-grained sand, and of the enrichment of rich or poor stuff. Three or four of these jiggers may be combined together, so as to treat coarse sand as it is delivered from the trommels. Any necessary adjustment of stroke for jigging the stuff successfully is readily effected by shifting the cheek (*p*) on the driving lever (*r*). Water may be supplied to the hutches either by a wrought-iron pipe, furnished with a stop-cock, or by means of a simple launder. The quantity of stuff jigged per hour will depend greatly upon the difference between the densities of the ore and the gangue. The length of piston-stroke must also be governed by the size and specific weight of the stuff under treatment. The length of each sieve is 21 in.; width, 22 in.; depth of piston, 9 in.; width of regulator, 3 in.; depth of hutch, 4 ft.; width, 4 ft. 3 in.; length, 6 ft. 6 in.; thickness of cast-iron shell, ⅝ in. When the rocking-shafts of three or four machines are driven by an horizontal rod the speed is set at from 70 to 80 strokes per minute. JOHN DARLINGTON,

2, Coleman-street-buildings, London.

DESTRUCTION OF FIRE-DAMP, AND EXTINGUISHING FIRES.

SIR,—As promised, I herewith enclose you a sketch of a new invention for extinguishing fire, depolarising hydrogen, and other gases. This machine is constructed on scientific principles, and is intended for numerous other purposes besides that of extinguishing fire. The tank is 2 ft. 6 in. long by 2 ft. wide, and 2 ft. deep. The vacuum chamber, which connects the pump with the water to be used in the tank, is 1 ft. in diameter and 2 ft. deep. The pump is 4 in. in diameter, double action, 10-in. stroke, and works metal and metal at the end of each stroke. On the left hand side is a small stove, with a pierced ring in its interior; this stove is 9 in. in diameter and 14 in. deep, with a ventilator in the bottom for admitting air to the stove, and a door and frame fitted air-tight to the top, 3 in. in the clear, to admit fuel. A small pipe runs from the stove about 18 in. high. Half-way up the pipe is a small pulse-valve for preventing back action from the pumps in case of leakage, and so adjusted as to work in harmony with a foot-valve in the vacuum chamber that supplies the water to the pump. Between the pulse-valve and the vacuum chamber are two adjusting cocks for regulating in exact proportions the supply of gas and water. In the stove I mix a combination of mineral, animal, and vegetable charcoal. When the pump is set in motion I apply lighted paper to the bottom of the stove, burning off the cock that furnishes the water from the vacuum chamber, and in one minute the stove is in full action. The gases being blown through the air vessel on the top are wasted for a minute or two, the apparatus connecting the water and gas cocks is then adjusted, and the machine is ready for use, two minutes being ample for bringing it into full operation. The three-way cock on the delivery nozzle is shut off, and the pressure in the air or gas chamber, whether in the top or fixed in the tank, is worked at 150 lbs. on the square inch. A pipe of any convenient length, and about 1 in. in diameter, is then connected with the machine, and on the end of the pipe a discharging nozzle is attached capable of furnishing a single jet, a spray, or a fine mist. On the inside of the discharging nozzle a pressure gauge is fixed, the fireman having the control of the operation keeps the point of discharge at 150 lbs. pressure on the square inch.

It is to this point I wish to direct the attention of the readers of the *Mining Journal*, or such persons as may take an interest in this invention. The gases generated and poured into a glass, 6 in. long, at the pressure before mentioned are retained in the water for several minutes, and when thrown upon the fire sink to a temperature of from 40° to 50° Fahr. One cubic foot of this fluid discharged upon any burning pile is capable of doing as much execution in extinguishing fire as 50 cubic feet of water from any ordinary fire-engine. It is the peculiar feature of this invention that a fire is extinguished in 1-20th part of the time now occupied in extinguishing it with water, and the results are unfailing. I have carried out numerous experiments with this invention, and feel confident that the conditions at present in use for extinguishing fire will have to go through a modification, and the simple apparatus, before described, be attached to every fire-engine where there is any desire to adopt principles, and to extinguish fire at the smallest expense and in the shortest possible time. There is a small mercurial gauge glass to indicate the condition and height of the water in the vacuum chamber. It is not necessary that all the apparatus shown in the diagram be attached to every fire-engine, as this engine has been expressly fitted with a view of demonstrating mathematically its various capabilities in producing fluids mixed with gases of various densities, capable of being applied to numerous purposes.

Under the new arrangements which the Fire and Water Company is preparing fire-engines will be of little use, as new conditions will be submitted, which will entirely alter our present notions of dealing with fire. A large skeleton map of London is being prepared, indicating 2500 receivers or store vessels. These may be fixed in cellars, under pavements, or in warehouses. The contents of such vessels will vary from 150 to 1000 gallons, and will weigh, when complete, from 350 lbs. to 2¼ tons. Pipes, valves, and all necessary apparatus will be attached to these stores, which may be instantly brought into operation by any person of average ability. The training of the general body of firemen will be of the most simple character, and they will be instantly in a position to extinguish a fire of any extent. We do not recommend sending for fire-engines when a fire occurs—the time is too precious when life and property are to be saved. But we feel it to be essential that, while such apparatus is in use, engines of small dimensions shall be manufactured, containing store vessels of considerable capacity, as it must strictly be borne in mind that it is not the quantity of water required in this invention, but the quality of the fuel employed.

Another important point that we have discovered in developing this invention is its enormous capability of instantly depolarising vast quantities of sulphurous vapours, carbonic acid gas, carburetted hydrogen, and sulphuretted carburetted hydrogen. A delivery jet of ¼ in. in diameter is capable of instantly extinguishing and depolarising carburetted hydrogen from a 2-ft. main, working at 3 in. pressure from the gasometer. Arrangements may be made in coal pits, mines, caverns, cellars, tunnels, ships, and subterranean railways, for instantly rendering the air pure and healthy. This is another point to which I beg to call the attention of engineers and persons engaged in mining operations. It is impossible to mention at present the numerous uses to which this invention may be applied

For instance, for softening water, for brewing and dyeing, and particularly for preventing incrustations in steam-boilers.

Another important feature is its application to gas fittings—a pipe may be attached to the inside of the pipe leading from the receiver from any part of the premises, and connected 1 or 2 ft. above the meter. A small self-acting pulse-valve may be connected near the outlet of the metre, and small discharge-valves, fitted at various points of the building, near the gas-burners. If, for instance, all the cocks fitted in a cotton mill or other factory were closed, and one of the small pulse-valves (a ¾-in. in diameter, constructed to lift at 150 lbs. on the square inch, with a few fine holes, capable of distributing a thin mist over the building) be connected on the gas-pipe, a fire may be extinguished in from one to five minutes with certainty, although the fire raged through every storey from the top to the bottom of the building. This will be found the most efficient means of dealing with fire where property of an inflammable character is exposed. I hope I have been sufficiently explicit in my endeavours to explain some of the leading features of this discovery. You are aware that for 20 years I have taken a deep interest in the welfare of the mining population of this country; and had it not been for the calamities daily occurring in the mining districts (to some of which I have been an eye-witness) nothing could have induced me to make the serious sacrifice of time and money I have devoted to this subject. But, having discovered a remedy for these evils, I am determined, as far as I possibly can, to bring this invention into practical operation in such districts; and in my next letter I hope to furnish all interested in mining property, and the welfare of the mining population, with a general plan of procedure, by which this simple invention may be at any moment put into immediate action, and counteract the deadly influences now operating in the mines, caverns, and subterraneous passages of the mining districts. I may further state that the parties with whom I am working will be ready at all times to meet the requirements that may arise from time to time in the mining districts at a trifling cost, as it is not our intention to form a great monopoly, but we rather depend on the universal adoption of our plan as compensation, by which method we hope to gain the general support of the mining population, seeing that the invention, if properly carried out, will protect the lives of the miners, the property of the proprietors, and set at rest, for once and for ever, the question of man's capabilities of controlling fire. THOMAS ATKINS.

26, *Budge-row, Cannon-street, London.*

MINING ON THE RHINE.

SIR,—In the Supplement to the Journal of Dec. 16 I find your Correspondent reports another wonderful discovery of copper ore on the Rhine. It is always cheering to miners to hear of discoveries of minerals, but when these discoveries are much over-rated it often ends in sad disappointment and heavy losses. The articles written by your Correspondent during the last three years on Mining on the Rhine are indeed very strong, and undoubtedly he tells the truth when he says they have induced many to invest their capital in the mines named by him; but, sad to say, I learn by enquiry that the so-called by him celebrated and rich St. Josephberg Mines, instead of paying the enormous dividends promised, are not returning mineral enough to half pay the working expenses—and as to the celebrated and rich Phœnix Lead and Silver Mines, the last account I heard is that the bailiffs were in possession, and that Capt. Richards, the manager, who had promised the company such handsome profits, had not been seen in the neighbourhood for some weeks. This really looks rather dark, and as your Correspondent takes upon himself the credit of having been the chief agent in bringing these wonderful undertakings before the public, I know you will agree with me in saying that he is in duty bound to give the public, through the columns of the Journal, some explanation as to the reason of these disappointments.

I do not for a moment wish to depreciate mining in this part of the world—in fact, I know that Rhenish Prussia can boast of some of the best mines in Europe, and there are still undoubtedly good mines yet to be developed in this neighbourhood; but I would advise English capitalists before they embark in mining on the Rhine to get the property inspected by some independent agent who has had experience in Prussian mining—for instance, there is Mr. Samuel Grey, at Cologne, and Captain Walls, at Bensberg, near Cologne. These gentlemen have been connected with mining in Prussia for nearly 20 years, and have always given their employers the greatest satisfaction. I have been informed by different parties who have employed them that their reports are correct and truthful.

Dec. 22. A RHINELANDER.

AMERICAN MINING EXPERTS.

SIR,—If I were to say comparisons are odious it would as well, if not better than anything else, express the sentiment I experienced on reading Mr. H. Sewell's letter under the above heading, published in the Supplement to the Journal of Oct. 28. I am unable to see from my knowledge of the two classes of individuals prominently noticed by Mr. Sewell—the "Freiberg pupil" and the practically-experienced Cornish mining engineer—the propriety of the simile he has drawn between them. What have they in common with one another? is a question pertinent to the issue, not even excepting that "self sufficiency" refered to by Mr. Sewell.

If I were to attempt the most candid comparison of the two classes of individuals I am quite sure my efforts would inevitably result in a contrast, for there is no other analogy between the two than that found to exist between a furnished and unfurnished shop or store-room; in the one case all the fixtures, receptacles, and recesses are provided and well furnished with the several commodities intended to be dealt in, whilst in the other case the fixtures, receptacles, and recesses only are provided, and all that is necessary to furnish them have to be acquired, and with the help only of a catalogue, so to speak, descriptive of the various classes of articles they were fitted to contain. The knowledge of one class is founded on experience; that of the other, being gathered from books and oral instruction, has no foundation at all, until step by step the tyro has had sufficient opportunities afforded him of testing experimentally his speculative ideas or theories which constitute his whole stock and store of mining knowledge.

Mr. Sewell aims at illustrating, though somewhat indirectly, the unfitness of Cornish mining captains for foreign service, by asking if you would place a foreman or manager who had never seen anything but the Almaden "Cinnabar" Mines of Spain in charge of a tin mine of Cornwall? The answer to which would, undoubtedly, be—No; but reverse the proposition, by submitting its converse or antithesis thus—Would you place the Almaden or any other cinnabar mine in charge of an experienced and competent manager of a Cornish tin mine? and the answer would unhesitatingly be—Yes. It is pertinent to a proper solution of the question to enquire how this is? and I answer—The professions of the Cornish agent extend only to mining proper—that is to say, to the most economical development and extraction of the ores and metals contained in the mines entrusted to his care. It is, therefore, comparatively immaterial to him to what class the particular metals he is in pursuit of belongs.

I would not, however, be understood as saying that there are no differences between gold, silver, cinnabar, tin, copper, and any other class of mining, but I do say that the experienced Cornish mining engineer embraces within the realm of his own personal knowledge all the fundamental principles of metallic mining, and that with these, aided by his judgment, a sufficient foundation to elaborate every modification necessary to adapt itself to every individual specific metallic mining enterprise exists. Metallurgical science has formed no part of his education, which in his own country was absolutely unnecessary, and is not prominently required of him in foreign countries—less of him than almost of any other,—for this reason—that when he is sent abroad it is generally for the purpose of examining or developing established or existing mines, whose metals are equally well known in a general sense and understood, and not for the purpose of discovering and establishing those facts.

It is not surprising, therefore, that the Cornish mining engineer has confidence in his own experience and professed abilities; and, indeed, this confidence when established, as it generally is, not by individual comparison of self with self, but of self with others, it becomes in him and to him a decided recommendation, modestly esteemed by himself, and strenuously appreciated by others.

If it was deliberately intended, I cannot conceive of a more flagrant attempt at disparagement of a very useful class of men, and who generally are as unpretending as they are useful, than by a comparison of them—Cornish mining engineers with Freiberg fledgelings. Mr. Sewell must be sadly deficient both in his judgment and discrimination not to perceive the difference between the two classes of individuals, and the basis upon which the judgment of each is exercised. The basis of the practical man's judgment is experience, and analogy, therefore, becomes his rule and guide. Whilst to the theorist, or book-made miner, all his principles of thought and action are launched speculatively—that is to say, upon the testimony of others, and without knowing from personal knowledge whether such testimony is supported by facts, or whether such facts, if existing, have any relation to such a concatenation or condition of circumstances as those with which the individual—applicant to such sources of knowledge—is called to exercise himself.

I can scarcely entertain the idea that Mr. Sewell intended disparagement of the Cornish mining engineers to the extent implied in his unqualified remarks, although his "apparently" incidental, but positively dogmatic, way of expressing himself evidently denotes a foregone conclusion in his own mind, as if the ostensible fact had become proverbial, and now aptly served as a standard of illustration for all supposed or arrogated similar conditions, and hence his practical development and application of the idea, as follows:—"The youth that leaves Freiberg full of scientific experience is as self-sufficient when he turns out into the world as some of our Cornish practitioners," &c.—a comparison, I repeat, as odious to the Cornish mining engineer as it is far fetched and ill applied, besides being utterly unwarranted by the circumstances, uncalled for, and unjustifiable.—*Elsworth, Nye County, Nevada.* ROBERT KNAPP.

OFFICIAL ENDORSEMENT OF THE MINING BUREAU OF THE PACIFIC COAST.

The following official despatch, the publication of which has just been authorised, on account of public interest, settles definitively the degree of reliance which may be placed upon the standing and workings of the Mining Bureau by European investors in American mining enterprises. This important official document needs no comment—it speaks sufficiently for itself:—

Translation of a Despatch, dated Oct. 2, 1871, *by* Mr. EDMOND BREUIL, *Consul-General of France at San Francisco, to His Excellency the Minister of Foreign Affairs of France at Paris:—*

Col. J. Berton, Vice-Consul of France at Sacramento, founded at the beginning of this year, and under the name of the "Mining Bureau of the Pacific Coast," an association having for its object to develope the rich mines of this coast with the aid of foreign capital, which can be obtained at a much lower rate of interest than in California, to protect such capital, and to encourage its investment in Californian mining enterprises, by making known in Europe such mines as are really valuable.

In order to appreciate the usefulness of such an institution as the Mining Bureau, it is necessary to well comprehend the condition up to a recent period of the mining market on the Pacific Coast. Since the discovery of gold in California hundreds of millions have been extracted from her soil, but together with mines offering guarantees of an advantageous development, in which foreign capital could be invested with profit. This country had numerous valueless quartz mines, represented as being very rich by their owners, and being sold as such to too credulous purchasers, tempted by the fabulous profits of some adjoining mines, and subsequently meeting with a complete deception.

In order to put an end to that organised system of swindling, Mr. Berton conceived the idea of establishing the Mining Bureau, the object of which is to examine the value of auriferous and argentiferous lands sought to be developed, to give such enterprises as are genuine an endorsement which would confer upon them a real value in the money market of Europe.

As may be easily believed, Mr. Berton met, from the beginning to even now, with a formidable opposition from that notorious class of swindling operators in "wild cat" concerns, who felt themselves seriously menaced in their nefarious business, and, unfortunately, some of them used even calumny as a legitimate arm. But they had to deal with a man of an energetic nature, who is stimulated rather than disconcerted by obstacles, and Mr. Berton, persevering in his way, has met with the most brilliant success. Foreign capital is now flowing to this coast to seek investment in mining enterprises endorsed by the Mining Bureau, the office of which is at Sacramento, the capital of the State of California, while it withholds itself from those which have not received its endorsement.

Should your Excellency condescend to peruse the enclosed proceedings of the first annual convention of the Mining Bureau of the Pacific Coast you will find ample details concerning the progress of that institution, which deserves to be particularly encouraged.

EDMOND BREUIL, Consul-General of France at San Francisco.

The foregoing translation is correct. BELCOUR,
Chancellor of the Consulate-General of France, San Francisco.

San Francisco, Dec. 1.

REPORTED DISCOVERY OF TIN AT UTAH.

SIR,—Since I last wrote you I have made an inspection of the reported tin discovery at Salt Lake, Utah Territory, of which so much has been said in the public papers of this county as to its richness, &c., and in which a great many have purchased very largely, some of whom, I am informed, have gone to London to get up a company to work it, with statements from the assayers that the yield of the rock is from 25 to 35 per cent. of tin. I am sorry to say that these statements have been confirmed by some Cornish agents who have seen it. What their object is in representing such gross falsehoods I will leave the public to judge, and I trust they will not be led away by them, as there is not a particle of tin in the district. What the parties have been working on is nothing more than a dyke of trap-rock running through the mountains of quartzite and mica slate, from which the assayers assert that they take the tin, which is in a metallic state, and not an oxide; and this, I am sorry to say, has been confirmed by some Cornish agents; and if the names of these agents are brought before the public I hope you will publish them in the Journal, in order that it may be seen who they are.

The silver mines of this district I was prevented from seeing, the roads being impassable on account of the snow. I shall, however, pay them a visit as soon as possible, and will then write you respecting their prospects.

I am glad to inform you that the mines in this district are improving in value, and will, no doubt, continue to do so, as they are properly developed. The Kent County, Nevada District, has been leased by four Cornishmen for two years; it pays one-twentieth part of all the gross proceeds to the shareholders, free of expense, and now leaves a profit of 400*l.* per week between the four partners, and further improving as developed. This mine was abandoned for its poverty some time since, owing to its bad management, and was thought worthless by many until the present parties took it, and commenced to work it in a miner-like manner. Hence the results. The Gunnell is also turning out well to the lessors, and will in a few days be forked to the bottom, when much greater profits will, no doubt, be realised. Other mines are being leased that have been abandoned, in consequence of their not paying, to practical men, who will, no doubt, make a good thing out of them by practical working, and from what I have seen of the mines (as I have before stated through the Journal) with proper management in the working, and a proper selecting of the ores for smelting and stamping, they cannot fail, if of sufficient length of ground, to make large profits to the shareholders.

I was much pleased to see the prospectus of the Illinois in the *Mining Journal* of Nov. 4, which, I am glad to say, is a good mine, and, if properly worked, will be a prize to the fortunate shareholders. I have been through the mine to-day, and I am glad to state that it is in the best condition, and worked more in a miner-like manner than any mine I have seen in Colorado. With proper development in depth it cannot fail proving a rich and lasting mine.

I have no doubt there is a great deal of worthless property in this country offered for sale in England, and, since it is found that English capital is being invested, a great deal more is in preparation, to be offered in the spring. I have seen some of the reports that are being got up in the most glowing terms, and signed by men styling themselves "Mining Engineers," to deceive the public, and to make a few dollars themselves. But, Sir, I hope the mining community of England will not be deceived by such persons, as some of these people are as ignorant of mining as though they had never seen a mine; and I must here inform you that every person who can wheel a barrow or drive a span of mules over the road is an "M.E.," and persons who can put a stick of wood into the fire-door of an engine is an "Engineer," and think they know as much of mining and engineering as the most practical men of the day. Such persons as these and their mining operations I shall make known through the Journal, as I am determined to expose everything that is not of a legitimate character, and to recommend nothing but genuine property in which the capitalist need have no fear of investing their money. If properly selected, and the workings placed in the hands of honest and practical men, Colorado mines will not be second to those of any other country in the world for profits.

Central City, Nov. 27. H. B. GROSE.

[Next week I shall write you on the important discovery of silver in Summit and Park County, which is the richest yet opened in all the Rocky Mountains.—H. B. G.]

THE UTAH MINING COMPANY.

SIR,—Unless it is pretended that Capt. Nancarrow, Mr. Sewell, Mr. Bateman (the vendor), Mr. Altman, and Mr. Murphy have entered into a conspiracy to palm off on the English public a worthless property through the medium of gentlemen who live in the esteem and confidence of the English public, and who are well acquainted with mining matters, the property of the Utah Mining Company is a very valuable one, and the present price of the shares is due solely to the somewhat common error of a miscalculation in the amount of working capital required. To have expected to develope a large mining property, and establish extensive smelting works in a foreign country, with 10,000*l.* was to take a too sanguine view of the subject, and it appears to have been done in spite of a letter written to one of the directors on this subject by Mr. Sewell. It is questionable if Mr. Sewell adopted the best method of doing this, but the fact that he did so write has not been officially denied, and must be taken for granted.

All the reports go to prove that the intrinsic value of the mines has largely increased since they were purchased by the company. On the directors, therefore, must rest the responsibility of the present depressed price of the shares, and they will, doubtless, adopt such measures to remedy the effect of the error arising from their miscalculation, as will show their confidence in the undertaking, and at the same time protect the interests of the present shareholders, many of whom purchased their shares at a high premium. To issue additional share capital at the present price would shock public confidence, and lower the reputation of the directors. The public has purchased shares in the undertaking, because it believed in the judgment, integrity, and position of the directors, and it behoves them to adopt such a course in providing the necessary additional capital as will show that in their opinions there is no change—that, in fact, they think as highly of the property now as they ever did.

To me it appears that the whole matter lies between the vendor and the directors. If they raise the necessary additional capital at par among themselves, or in such a manner as will not materially increase the total capital of the company, public confidence will be restored, and errors of judgment condoned. This done, and with a more far-seeing and vigorous management at the mines, the undertaking will speedily emerge from the present depressed condition, and take a high rank in the list of foreign mining enterprises. A.

Dec. 27.

UTAH MINING COMPANY.

SIR,—For two weeks past has your Journal informed us that these shares have declined, owing to a rumour that further capital will be necessary. Presuming that this statement is well founded, for what reason are the shareholders so long kept in the dark? No reference has yet been made to this subject in the published reports from the manager, although no reasonable doubt can exist that our commissioner, Mr. Eagle, long since apprised our board of the financial condition of the company. Is it fair that our executive should thus withhold information, which is as much the property of the shareholders as of the board? Is it true that the furnace just completed is found useless? If otherwise, why have arrangements been made for renting another? One of the letters which appeared in the Journal last week, from a scientific authority in the district, points out that a radical alteration has taken place in the character of the ores in depth. Is it to this we are to attribute the rumoured inapplicability of our newly-constructed furnace?

I would ask my fellow shareholders whether, if the directors persist in their vexatious silence, they have not the power, under the Articles of Association, to convene a special general meeting, to ventilate these vital questions? If we do possess this prerogative, let us exercise it without delay. In the face of the shares having declined from a high premium to a heavy discount, notwithstanding the uniformly satisfactory character of every published report, apprehensions are naturally excited that there is much yet to be published far less satisfactory. I hope this communication will be the means of eliciting some statement from our board, or of some concerted action being set on foot demanding the information to which we are justly entitled. A SHAREHOLDER.

Dec. 28.

SWEETWATER MINES.

SIR,—The Miners' Delight Ledge was discovered in June, 1867, and was the second ledge located in the Sweetwater country. It is situated at the extreme north-east corner of the Gow Belt, it being bounded by limestone formation on the north and east, and the Gow Belt on the south and west. The outcroppings are traceable for quite a distance, and the ledge or vein is contained within the slate and granite formations which is so noticeable in all fissure veins in this section. The Miners' Delight proper consists of 1600 ft., running in a north-east and south-west direction, and is owned by two companies—the West and East End Companies. The ledge is easily traced, and inclining at an angle of 75° south.

This mine has had the most work done on it on its west end by the West End Company, and this sketch will, therefore, be of the operations of the West End Company, leaving the East End for future consideration. The West End consists of 800 lineal feet, and is owned by five persons. It is situated just 500 yards from Hamilton city, and has the following development, to wit—Discovery shaft, 89 ft. deep, with drift east 98 ft., and west 220 ft.; one other shaft, 70 ft. deep, with drift west 200 ft.; plain working shaft, sunk perpendicularly, with intention of striking vein at a depth of 150 ft., now down 143 ft., and vein struck by cross-cut, showing a continuous ledge and good vein of ore.

The mining facilities of the region where this mine is situated cannot be exceeded. A plentiful supply of water is at hand, together with an unlimited supply of wood both for fuel and mining purposes. Hamilton city also furnishes a good market for the purchase of mining supplies and disposal of gold. The military post of Fort Stambaugh is but 1½ mile, and Atlantic and South Pass cities but 4 and 7 miles respectively from the mine.

There are now situated upon this end of the mine a complete 10-stamp mill and hoisting works combined. Before the erection of the mill the quartz was hauled 7 miles to the Hermit Mill, and was crushed at an expense of $28 per ton; 100 tons, after the deduction for crushing, yielded $103 net per ton; also 84 tons, at the same mill and at the same rates, yielded $64 80 c. per ton net. Since the company's mill was erected the books of the company (which have been examined in the interests of this letter) show that 2000 tons of rock have been crushed, yielding on an average $25 75 c. per ton. The cost of mining and milling the ore is not above $10 per ton, leaving a net profit of $15 25 c. per ton. At the present there must be 2000 tons of ore in sight in this property; but during the winter it is engaged in reducing its old waste dump, which is more than paying all expenses.—*South Pass City, Wyoming, Dec.* 6. H. C.

THE BRAZILIAN MINING COMPANIES.

SIR,—It is not difficult to discover the double object of the letter of "A Subscriber," which appeared in the Supplement to last week's Journal. Without wishing to direct attention to the fact that it has taken "Subscriber" hard upon three months to reply to the announcement as to the merited manifestation which took place upon Capt. Treloar's departure from Brazil, nor to contradict *seriatim* the various unfounded statements "Subscriber" has put forward; I would remind him that there is such a thing as common fairness, honesty, and justice, and that it is obviously unjust to denounce any man, and especially when the denunciations proceed from one shielded behind an anonymous signature, until he has had a fair opportunity of vindicating his professional reputation. The judicial dictum—*audi alteram partem*—is acknowledged and respected on all sides, even when there is reason to believe the allegations have some foundation in fact, but when condemnation is founded upon baseless statements which "Subscriber," if he does not already know, could have easily informed himself were utterly contrary to fact, the greater caution should be exercised in accepting anything emanating from such a source. I have no doubt that "Subscriber" is one of those who used to sing Capt. Treloar's praises far and wide when Don Pedro was paying "larger dividends than any other foreign mine;" when cordial votes of thanks were always being accorded to him; and when he was "the most astute, zealous, and economical mine manager in Brazil;" but, as is usual, when such men as "Subscriber" have reaped their harvest out of the plenitude of success, it is their wont to endeavour to gain another by blackening that which, in the very course of things, is inevitably sure to be ever alternating. How often has Capt. Treloar himself cautioned us in

his reports against being unduly elated at an exceptionably high produce, and depressed at a marked decline? How often have we been told by one "who knew Capt. Treloar best" that "his every statement was always more than realised?" which was proved by the results of each successive year; and yet now, forsooth, no good word can be said in his favour!

Does "Subscriber" know that Capt. Treloar had no more to do with the purchase, nor in recommending the purchase, of the Sao Vicente Mine (East del Rey) than "Subscriber" himself? Does "Subscriber" further know that Capt. Treloar had also nothing whatever to do with the purchase of Taquaril, for, as in Sao Vicente, a company had been formed long before Capt. Treloar's services were solicited? If Anglo-Brazilian prove a success it will be from the newly-acquired mine; and to whom, may I ask, are we indebted for that? The General Brazilian will be equal to all that has been said of it; but as Rome was not built in a day, so no more can an enormous property like Santa Anna be developed to a remunerative condition without vexatious delays and unexpected expenditure.

Let "Subscriber" consider these facts, and whatever may be his ulterior designs pause before again traducing the professional reputation of "the most astute, zealous, and economical manager in Brazil," by the publication of misstatements.—*Dec.* 27. Audi Alteram Partem.

[For remainder of Original Correspondence see to-day's Journal.]

FOREIGN MINING AND METALLURGY.

Navigation still continues interrupted upon some French canals, although the frost has broken up to a great extent; at the same time, the demand and consumption appear, upon the whole, to be somewhat less pressing and to be better satisfied. Coal for household consumption is, however, very scarce, and as much as 2*l.* 12s. to 2*l.* 16s. per ton has been paid for it, those terms including delivery. Several porcelain works in the neighbourhood of Limoges have been obliged to suspend operations in consequence of a scarcity of coal.

As regards the French iron trade, it may be observed that while the aspect of the transport question has not experienced any very material improvement, several of the rolling mills which had been reduced to an enforced idleness have renewed operations, while some blast-furnaces have been re-lighted. A check of a single day in the deliveries of combustible would, however, re-develope the crisis, as there are scarcely any stocks of coal, and the coal which comes to hand barely suffices for the daily consumption. Some works still remain in a suffering condition with respect to coal; thus the Fourhambault forges and foundries have just stopped working in consequence of a deficiency of raw materials, as well coal as pig. The Berry canal has not been in work for over a year, and railway traffic is still conducted only irregularly. The demand is heavy and prices are firm; at the same time, the advance in prices is less decided than the rise noticed in coal. The bulletin of the committee of French forgemasters has resumed its publication, which has been suspended since Aug. 25, 1870. The intelligence received from the construction workshops is excellent. Several new companies have been obliged to order their machinery in Alsace, although a duty will have to be paid next year; this is a result of the great difficulty experienced in procuring machinery in France. In the Haute-Marne puddled iron from charcoal-made pig remains firm at 9*l.* 12s. to 9*l.* 16s. per ton; mixed ditto, 8*l.* 16s. to 9*l.* per ton. The Hombourg Steel Foundry in the old Moselle district has purchased at Dieulouard, in an excellent situation between the railway and the canal, a large piece of land for the prosecution of its important manufacture. The buildings have been commenced, and it is expected that the works will be in operation next summer.

The advices received from the French copper markets are very satisfactory; prices have been sustained, and in some cases they have displayed an upward tendency. At Paris, Chilian in bars delivered at Havre has made 87*l.*; ditto, in ingots, 92*l.*; tough English, 94*l.*; and Corocoro minerals, pure standard, 88*l.* per ton. At Havre, 88*l.* per ton has been obtained for some disposable first marks. At Marseilles the tone of the article is regarded as satisfactory, and prices continue to rise. The reports from the German markets display a little less animation; this is attributed to the close of the year, and to the inadequate supplies of rolling-stock upon the railways; prices remain well-supported in Germany, and are even advancing in some cases. A reaction has occurred in tin upon the French and German markets. At Paris, Banca delivered at Havre or Paris has made 160*l.* per ton; Straits, 160*l.*; and English delivered at Havre or Rouen 164*l.* per ton. At Rotterdam tin has been very quiet, and has even fallen to some slight extent; Banca has made 87¼ fl. at Rotterdam; disposable Billiton is very scarce. The aspect of the lead trade is regarded as favourable. At Paris, French delivered at Paris has made 19*l.*; Spanish delivered at Havre, 18*l.* 12s.; and English, 18*l.* 16s. per ton. Silesian zinc delivered at Havre has been quoted at 22*l.* 16s.; and other good marks, 22*l.* 12s. per ton. At Marseilles, Silesian zinc in plates has been dealt in at 24*l.* per ton in warehouse; rolled zinc, 28*l.*; and re-cast, 19*l.* 4s. per ton. Upon the German markets stocks are exhausted, and a fresh advance is anticipated.

The complaints made with regard to the rolling stock question in Belgium are still continued, but display, upon the whole, less bitterness than of yore. Whether a tardy reform has been introduced into the abuses prevailing with regard to the distribution of railway plant, or whether the breaking up of the frost has enabled deliveries to be made by water, it is clear that stocks are diminishing with rapidity. The extraction can, indeed, barely meet the wants of consumers, and the anticipated advance in prices has commenced. Coke can scarcely be found, and the advance in this article is in consequence still more decided. Washed coke has made 1*l.* 1s. 8d. to 1*l.* 3s. 4d.; unwashed, 19s. 2d. to 1*l.* 0s. 10d. per ton, put on trucks at the mine, and 1s. 3d. more per ton for deliveries by water. Important contracts have been concluded for 1872, and those expiring with the close of this year are being renewed. The new year presents itself, then, under favourable auspices, and if the much-vexed transport question can be satisfactorily settled—as it can scarcely fail to be settled to some extent on the delivery of the trucks ordered—the Belgian coal trade may expect better times.

The Belgian iron trade has been characterised by general activity, firmness in prices, hopes of a further advance, and, what perhaps is most remarkable of all, an improvement in the transport question. Belgium appears to be obtaining a better and better footing upon the great European markets. The Turkey in Europe Railway Company has ordered 9200 tons of rails from MM. Blondiaux and Co., of Thyle-Chateau, at 7*l.* 9s. 3d. per ton, delivered at Antwerp. MM. Finet, Charles, and Co. have also undertaken for the same company the construction of a great iron bridge of 1333 ft. span over the Maritya. It is stated that of the iron bridges imported into Russia during the last three years France furnished 41 per cent., Belgium 30½ per cent., England 20¾ per cent., and Germany only 8½ per cent. The various railways in course of execution or projection in Russia are expected to involve important further deliveries of bridges. A new concern for the production of Bessemer steel has been founded, under the title of the Angleur Steelworks Company; M. Gustave Pastor, jun., will direct the works of this company. A denial has been given to a rumour that the Vieille Montagne Company proposed to close the works which it has for some time carried on in the neighbourhood of Liége. The rail rolling-mills are now overdone with orders, and are not now entering into fresh contracts, except upon seriously remunerative terms. This result is the more satisfactory since until recently this branch of the Belgian iron trade was the least favoured. Thus, official tables show that the exports of rails from Belgium in the first eight months of this year declined to the extent of 33 per cent., as compared with the corresponding period of 1870. Several contracts for refining-pig have been concluded in the Charlerol basin at 3*l.* 8s. per ton; these contracts have only been entered into, however, for very short terms. Rolled No. 1 iron has been dealt in at 7*l.* 4s. per ton; No. 2 plates have been dealt in at 10*l.* per ton.

MM. de Wendel, of the Moyeuvre Works, have obtained a contract for 2000 tons of rails for a German line. MM. de Wendel tendered at 74 thalers per ton, with delivery in July, and 72 thalers per ton with delivery in September, 1872; these were the lowest terms offered. There are considerable complaints as to want of means of transport upon the German railways. In Austria, also, combustible makes default from the same cause, and to make matters worse for domestic consumers the winter has been exceptionally severe.

Improved Steam-Boilers.—The invention of Mr. J. W. Boulton, of Ashton-under-Lyne, consists in combining with boilers having horizontal or diagonal flues, and having either cylindrical or stayed fire boxes, a series of water-tubes placed parallel to each other in sets, each set being fixed across the flue in a plane, at a right-angle to its axis, but with the tubes in a diagonal position, and with the diagonal inclination of the tubes reversed in each alternate set. He prefers to make the flues with tubes in them, so as to be secured to the shell of the boiler by flanges and bolts, and in some cases to make the flues with tubes in them in sections, to be secured by flanges and bolts, so that the flues or sections of flues can be readily removed when required.

FOREIGN MINES.

Don Pedro North del Rey (Gold).—*Telegram:* Produce weighed to Nov. 29, 6584 ozts.; estimate for November, 9000 ozts.

Pinto (Silver).—Capt. Plater, Dec. 7: The mines of the company are just now looking better than for the last month, the vein in the bottom of the Maryland having widened somewhat, and the ore improving in quality. The Mountain Chief also has widened, as we have gone deeper, the ore assaying about $100 per ton. The Michigan continues to produce well, and the Uncle Sam has indications of being a better mine than I supposed at the time of purchase; tunnel now in 480 ft. Our mill has been completed for some days, and a few more will finish the furnace.

Eclipse (Gold).—Dec. 27: The directors have this day received from the mines, through their agents, Messrs. Balfour, Guthrie, and Co. (San Francisco), one bar of gold, No. 7682, valued at $2087.

— Dec. 28: The following telegram has this day been received from Mr. Henry Tregellas:—"Partial of 151 tons; $1700; will improve."

Malpaso Gold Washing.—Messrs. Koppel and Schloss (the company's agents at Bogota) write under date Nov. 17—"The deed of transfer of the Malpaso property has been made out and signed. We appointed Mr. Gooding to receive the property, and his report and inventory taken goes enclosed. Dr. Navaez was appointed by us to investigate into the title deeds, and we enclose copy of his letter."—Mr. W. S. Welton (the company's general superintendent) writes under date, Nov. 19—"The board will observe by the minutes that Mr. Clarke has had a severe attack of illness; this has prevented him from being able to thoroughly examine the mine, and send a full report. From what Mr. Clarke saw of the mine before his illness he has a very high opinion of its richness and capabilities of being worked by the hydraulic system; since then I have again examined the water supply, and it appears to me ample for working on a large scale. I also find that the Rio Suclo could be brought in if a future time it should be found advisable to extend the operations very considerably. I have had Mr. Clarke brought to Santa Ana, in order that he may have better attendance, and I believe that he will be able to go to Malpaso shortly. In the meantime I shall carry on all the preliminary works that he may require, and by so doing I do not anticipate that any delay in the operations will have been caused by his illness."

Tolima.—The directors state that advices have reached them from Messrs. Koppel and Schloss, their agents in the United States of Colombia, to the effect that the purchase of both the Frias and Organos estates is completed, and their possession formally entered upon by Mr. Welton, the general manager, on the company's behalf. By letters from that gentleman, which reach them under the same dates, the directors learn that the prospects at both the mines are satisfactory, some of the ore invoiced on Oct. 27 giving an assay value of 767 ozs. fine silver to the ton, whilst the total assay value of the whole consignment gives an average return of 124*l.* to the ton. Although the works at the Organos Gold Mine are not yet in a state to give any returns, the average assay value of the ore from the Constancia lode has been found to be at least 1½ oz. of fine gold to the ton.

Battle Mountain.—Capt. Richards, Dec. 7: Virgin: The 113 ft. level north has been communicated with Truscott's winze, and the lode in the drift contains good stones of ore occasionally. In the stopes in back of the 113 ft. level, north of Roach's winze, the lode is of large size, and produces some good ore. In the 113 ft. level stopes, south of Roach's winze, the lode is of very large size, and, although somewhat fallen off in productiveness, is a good orey lode. In the 73 ft. level north operations are suspended during the putting in a stull in the back thereof. Jury's stopes, in back of this level, produce a small quantity of good ore. Thomas's rise is going up in a lode which produces some green carbonate and a small quantity of copper glance—a very promising lode. A midway drift is being put towards Thomas's rise from the stull in back of the 73, in a very promising lode, with a view of opening ground that will pay for stoping. A plat is being cut at the south side of the Virgin shaft, preparatory to driving a cross cut therefrom, to the Lake Superior lode, which at this point is about 15 fms. off only; this will intersect the lode at the 135 ft. there, and the ore from it, and also from the veins and lodes which may be intersected in doing this, will be brought to the Virgin shaft, and hoisted with less expense, and be assorted in the present ore-house. It will also be the means of thoroughly ventilating both the mines to their present deepest level. Ore raised during the week 516 sacks.

Cape (Copper).—The directors have received despatches per Cambrian. The Ookiep and Spectakel mining reports show no material alteration in the operations. The superintendent refers to the great want of labour, which seriously retards the mining and other works. Returns for October:—Yield from Ookiep, 525 tons; Spectakel, 100 tons. Transport from Ookiep to Hondeklip, 148 tons of ore; to railway, 700 tons of ore and 70 tons of regulus; Spectakel to Hondeklip, 97 tons of ore; to railway, 19 tons of ore. Bills of lading are received for 590 tons, per Iacna (sailed for Swansea Nov. 2); for 180 tons regulus, per present steamer; and 14 tons of copper ore per Celt steamer. The G. J. Jones, to load about 590 tons of ore, arrived at Port Nolloth on Oct. 30. Since last report 528 tons, ex Croydon, have been sold by public ticket (on 19th inst.), at 16s. 6¾d. per unit, realising approximatively 18,650*l.*, and by private contract on the 23d inst., 400 tons ex Don Ricardo, at 17s. per unit (not yet assayed).

Linares.—Dec. 20: Pozo Ancho Mine: The lode in the 85, west of Crosby's shaft, has fallen off in value since our last report. In the 75, west of Crosby's shaft, the lode contains a little ore, but nothing to value. The 75, west of San Francisco shaft, is opening up tribute ground, yielding 1 ton of ore per fathom. The lode in the 75, east of San Francisco shaft, is small, consisting of quartz and lead ore, yielding of the latter ½ ton per fathom. The ground is very hard and the lode small and poor in the 65, west of San Francisco shaft. In the 55, west of San Francisco shaft, the lode is compact and regular, yielding good stones of ore, worth ½ ton per fathom. There is no improvement in the 45, east of San Francisco shaft.—Los Quinientos: The lode in the 65, west of Taylor's engine-shaft, is still unproductive. In the 55, west of Taylor's engine-shaft, the lode is large, consisting chiefly of quartz and lead ore, yielding of the latter 1¼ ton per fathom. There is no improvement in the 65, east of Taylor's engine-shaft since last report. The lode in the 55, east of Taylor's engine-shaft, is yielding fine stones of lead ore, worth ½ ton per fathom. The 45, east of Addis's shaft, has fallen off a little in value since last reported on, yielding ¼ ton of ore per fathom.

The 32, east of Addis's shaft, is communicated to Henty's shaft. In the 32, east of Henty's shaft, the lode has failed, but is still looking well in the bottom part of the end, producing 1½ ton of ore per fathom. The 32, west of San Carlos shaft, is opening good tribute ground, worth 1½ ton per fathom. The lode in the 45, west of San Carlos shaft, is small, yielding occasional stones of lead. In the 55, west of San Carlos, the lode is small, but yielding good stones of lead ore. There is a strong open lode, yielding fine lumps of ore from the 55, east of San Carlos, producing ¾ ton of ore per fathom. In the 45, east of San Carlos shaft, the lode is regular, well defined, and looking well, yielding 4 tons per fathom. There is nothing in the 32, east of San Carlos, to value.—Shafts and Winzes: The ground in Carmona's winze, below the 55, is hard, and the lode quite unproductive. The lode in Salvador's winze, below the 32, is small, containing a little lead, but not enough to value. The lode in Perez' winze, below the 32 fm. level, is improving in appearance, and is now producing good stones of lead ore.

Alamillos.—Dec. 20: The lode in the 60, west of San Rafael's shaft, is large, but unproductive. The lode is small in the 60, east of San Francisco's shaft, yielding ½ ton per fathom. In the 60, west of San Francisco's shaft, the lode contains a little lead, but not enough to value. The ground is very hard for driving through in the 50, east of Magdalena's shaft. The lode in the 85, east of Taylor's engine-shaft, is now large and strong, containing good stones of lead, producing 1 ton of ore per fathom. The lode is small and poor in the 50, west of San Adriano's cross-cut. In the 50, west of San Yago's shaft, the lode is a little larger than it has been, but quite unproductive. The main slide is still in the 40, east of San Victor's shaft. The 40, west of San Victor's cross-cut, is opening out good tribute ground, yielding 1½ ton of ore per fathom. The 50 cross-cut, south of San Victor's shaft, has passed through a lode 8 in. wide, chiefly composed of quartz. In the 20, east of Addis's shaft, the men are put to drive north to prove another part of the lode. The lode in the 40, east of Crosby's shaft, has failed, and become quite poor within the last few days. A decided improvement, both in the size and value of the lode in the 50, east of Crosby's shaft, has taken place, producing 1 ton of ore per fm. The 40, west of Crosby's cross-cut, continues to open out fair tribute ground, worth 1½ ton per fathom. In the 50, west of Crosby's cross-cut, the lode is very irregular, but is opening out tribute ground, worth 1 ton of ore per fm. In the 75, east of Taylor's engine-shaft, the lode yields occasional stones of lead.—Shafts and Winzes: Fair progress is being made at Cox's shaft, below the 30. In consequence of a great influx of water it has been necessary to temporarily suspend Alejandro's winze, below the 40, producing now 5 tons of ore per fm. Rica's winze, below the 30, is going down through a good lode, worth 2½ tons per fathom. In Felipe's winze, below the 30, the lode is still very large, but not nearly so productive as it was, producing 1½ ton of ore per fathom. The lode is very regular in Sebastian's winze, below the 40 fm. level, yielding 1½ ton of ore per fathom.

Fortuna.—Dec. 20: Canada Incosa: The 110, west of Henty's shaft, is a large and promising lode, letting out much water. The lode in the 110, west of Judd's, is well formed, and improved in value since last report; yielding 1 ton of ore per fathom. The 80, east of Henty's cross-cut, has passed through another branch of the cross-course, which has disordered the lode. The driving of the 60, east of San Pedro's shaft, will be resumed as soon as we get the winze and level clear of stuff. The lode in the 90, east of Addis's, is small, and the ground hard for driving. The lode in the 80, west of Lowndes', is large, and of a very promising character; producing 1 ton of ore per fathom. We have just intersected the lode on the east side of the 80, east of Carro's shaft, but it is not well defined at present.—Shafts and Winzes: The man are now making good progress in Judd's shaft below the 90, which produces ½ ton of ore per fathom. The cistern and new plunger will be fixed forthwith, when we shall re-ume the sinking of Lowndes' shaft below the 80. Serrano's winze, below the 70, is going down in a valuable piece of ore ground, worth 2 tons of ore per fathom.—Los Salidos: The lode in the 110, west of Buenos Amigos shaft, is very changeable, and the ground moderately easy for driving; yielding ¾ ton of ore per fm. The lode in the 100, west of Buenos Amigos shaft, continues small, and ground hard. There is no change to notice in the 90 fm. level, west of San Carlos, since last report. The lode in the 75, west of San Carlos, is small, but kindly, and letting out plenty of water, yielding ¾ ton of ore per fathom. In the 110 fm. level, east of Buenos-Amigos shaft, the lode is compact, and looking something better than when last reported on, producing 1 ton of ore per fathom. There is no improvement in the 110, east of Morris's engine-shaft, as yet. The 100 fm. level, east of Cox's shaft, is passing through a splendid run of ore ground, worth 4 tons per fathom. In the 90 fm. level, east of San Miguiel, the lode is large and strong, composed of calcareous spar, quartz, and lead ore, yielding of the latter 2½ tons per fathom. We have commenced the driving of the 35 fm. level, west of Palgrave's engine-shaft, west of cross-cut; the lode is divided into branches, producing ½ ton of ore per fathom. The men are putting in a stope in the bottom of the 25 fm. level, west of Palgrave's engine-shaft. The 35 fm. level, east of Palgrave's engine-shaft is, like the same level west, being divided into two distinct branches, yielding ½ ton of ore per fathom.—Shafts and Winzes: The lode is small and compact in San Carlos shaft, below the 90 fm. level, yielding 2 tons of ore per fathom. There is a very good stone of lead ore going down in the east end of Jordan's winze, below the 100 fm. level, yielding ½ ton of ore per fm. The lode in Augustin's winze, below the 100 fm. level, is divided into several small branches, yielding ½ ton of ore per fathom. Medina's winze, below the 25, is situated east of Palgrave's engine-shaft, and in advance of the 25 fathom level, which we shall get down with all possible dispatch; the lode is rather broken up at present, yielding 1 ton of ore per fathom.

Lusitanian.—Dec. 20: Palhal: At Taylor's engine-shaft, sinking below the 150, the lode is worth 1½ ton of ore per fm. The men are about to cut a trip-plat in the 150.—Basto's Lode: In the 150, east of Taylor's, the lode is 4 ft. wide, composed of quartz and runners of country, with stones of ore. In the western end of this level the lode is half this size, worth 1 ton per fathom. The lode in the 140 east is 3½ ft. wide, unproductive. In the 140 west the lode is 3 ft. wide, yielding 1¼ ton per fathom. In the 130 east the lode is 5 ft. wide, composed of quartz. The lode is 7 ft. wide in the 120, east of River shaft, and yields stones of ore at times. In the 110, east of ditto, the lode is 2½ ft. wide, made up of flookan and chisto. Good stones of ore are found in the 90 east, where the lode is 1 ft. wide. We hope soon to get a looser lode to drain the 70, as the water is increasing. The adit level, west of Perez' shaft, contains a lode 3 in. wide, which gives some very good stones of ore. Mill lode, in the 38, east of Taylor's, is 6 in. wide, composed of flookan. The branch in the 38, west of Slide lode, is very small and unproductive. The slide lode in the 130, west of Taylor's, is 1 ft. wide, composed of flookan.—Rise and Winzes on Basto's Lode: In rise No. 89, above the 90, east of River shaft, the lode is 4 ft. wide, producing ¼ ton of ore per fathom. The lode in winze No. 89, below the 70, east of River shaft, is 4 ft. wide, consisting of quartz and flookan. No. 90 winze, below the 144 fm. level, west of Taylor's, contains a lode 3 ft. wide, worth 1½ ton per fathom.—Carvalhal: The ground in the 60 cross-cut, north of incline-shaft, is a hard gneiss, with spar.—Levels on Great Lode: In the 60 fm. level, east of the above shaft, the lode is 1 foot wide—poor. In the 50 east the lode is of the same size, and is spotted with lead. The 30 east contains a lode 2 ft. wide, yielding a little blende; and the 20 east a lode 1 ft. wide, composed of quartz and country.—Caunter Lode: In the adit level, west of incline shaft, the lode appears to be disordered by a cross run of country, with strings of flookan in it. In the rise above the 10 the lode is 3 ft. wide, composed of quartz and mundic, spotted with lead. The lode is 2 ft. wide in the 20 west, and gives 1 ton of lead ore per fm.; and in the 30 and 40 fm. levels west the lode is about 1½ ft. wide, composed of quartz, with spots of lead.

[For remainder of Foreign Mines see to-day's Journal.]

AUSTRALIAN MINES.

Yudanamutana (Copper).—Mr. Martin (Adelaide, Nov. 2) states—"I arrived here safely a few days ago, but as my time has been short I have not been able to go very deeply into matters. I learn, however, that they are not yet able to work upon Hill's lode, nor will they for a few weeks yet. I leave tomorrow for the mine, where I shall remain as long as necessary, and will go thoroughly into matters and do my utmost to bring about a more satisfactory state of things. I have reduced the superintendent's and secretary's salaries, and dispensed with the junior clerk, and will keep charges down to the lowest possible rate—nothing, indeed, that perseverance and energy can do shall be wanting to bring the thing into a satisfactory and paying condition. There is no report from the mine, and I fear that the make of copper will be but a little over 20 tons. There is a company formed since my arrival to carry a line of railway from Port Augusta to Port Darwin, and which will pass close to all our properties. There are many very influential men connected with it, and I have no doubt that it will be carried out. It is a grand scheme, and will benefit the colony much."

Port Phillip and Colonial (Gold).—The quantity of quartz crushed during the four weeks ending Oct. 11 was 5376 tons. Pyrites treated, 24¼ tons; total gold obtained, 1272 ozs., or an average per ton of 4 dwts. 17½ grs. The receipts were 477*l.*; payments, 385*l.*; profit, 91*l.*, added to which was last month's balance of 1432*l.*, making 2446*l.* The amount divided between the two companies was 1000*l.*; the Port Phillip Company's proportion was 650*l.* The balance of 1346*l.* was carried forward to next month's account. The return for the three weeks ending Nov. 1 was quartz crushed, 3604 tons; total gold obtained, 922 ozs., or an average per ton of 5 dwts. 12 grs from quartz alone; remittance, 500*l.*—The company have also received the following telegram, dated Gaite, Dec. 24, in anticipation of the mail leaving Melbourne on Dec. 5, and due here Jan. 20 next:—"Month ending Nov. 8, yield per ton 5 dwts. 18 grs. Fortnight ending Nov. 22, yield per ton 5 dwts. Struck Western Reef at lowest level. Quartz rich. Old Man lode improving south."

English and Australian (Copper).—Port Adelaide, Nov. 8: There were two furnaces smelting, four roasting, and one refinery in full work at the Port Adelaide Works. Since date of last advices shipments to the extent of 160 tons of copper had been made.

Anglo-Australian (Gold).—The directors have received advices, dated Fryerstown, Nov. 6. Mr. Kitto writes:—"I trust that long before this reaches you you will not experience great difficulty in getting in the calls in arrear. You will observe that the western shaft is being sunk at the rate of 4 fathoms (24 feet) per month, so that it will not be long before we shall be enabled to again cross-cut for the lode. The engineers are rather slow in preparing their plans of stamps, but as they are very careful, painstaking men a little delay is, perhaps, not to be regretted." Capt. Raisbeck reports on the mine as follows:—"I have the honour to report progress made on the above mine since the 9th ult.—No. 2 Engine-Shaft West: We have sunk 21 feet since the above date, placed the top lift in a cistern at 124 ft., and timbered 16 ft. of the shaft; at 148 ft. cut a leader from 2 to 4 in. thick, with gold showing well in the stone. This leader underlies west 12 ft. in a fathom; depth of the shaft from surface 161 feet. A new shaft has been commenced 500 feet south of No. 2 engine-shaft west. At 45 ft. we cut the lode 5 ft. thick, and underlying west 4 ft. in a fathom; the lode is well defined, with a strong flookan on the west side. Good prospects can be obtained with the tin dish. We are now driving east to cut some rich spurs which were found some years ago at the surface. On Saturday last we struck stone in this cross-cut, but not opened out upon sufficiently to report upon its value." Mr. Lamb also writes:—"I am glad to say that the sinking has been progressing favourably in the western shaft, 44 ft. having been sunk below the 118 feet level, while in the prospecting shaft south of this a large body of quartz has been struck at 45 feet from the surface. The pumps are not yet lowered in No. 1 engine shaft; it will take some days yet to complete the smiths' work belonging to these."

Yorke Peninsula.—The directors have received advices from Adelaide, dated Nov. 4 last, with report from the Kurilla Mine to the 6th of that month. The following are extracts from Capt. Anthony's report:—At Deeble's shaft the 25 west is driven a total distance from the shaft of 32 fms. At this point a branch of rich ore 1 ft. 6 in. wide is met with that will yield 3 tons of 15 per cent. ore per fathom. . . . The main lode is 7 ft. wide, composed for the most part of pyrites, mixed with copper ore and quartz. At the bottom part of the end there is a rich stone of yellow ore cropping up about 1 ft. from the bottom. At the 15 west the lode is 4 ft. wide, composed of pyrites, mica-slate, and rich coated copper ore. Total distance from shaft 16½ fms. I have not seen this drive so promising since we lost the ore near the shaft. It will be no matter of surprise if a great improvement takes place in this drive shortly. After another month's experience of the lode west of Deeble's my opinion of ultimate success is more than ever confirmed. With a very small monthly outlay I have discovered and driven over 16 fms. of ore ground in the 25 west of Deeble's, but I now want the means to turn it to profitable account, . . . I have only to add that if any prospective mining undertaking is worthy of a fair working capital this is.

Australian United (Gold).—Mr. Kitto, on Nov. 6, writes that the last of the company's debts would be paid on the following day, after which the balance-sheet would be sent home. He also states he is receiving tenders for firewood for the Central Mine.

Scottish Australian.—The directors have received advices from the general superintendent at Sydney dated Nov. 3 last, with report from the Lambton Colliery to the 2d of that month. The sales of coal for the month of October amounted to 12,588 tons.

Silver Mining in Eastern Nevada.—A correspondent at Treasure City of the *Wall-street Journal* (Dec. 16) writes—"A goodly portion of the mining property situated in the free-metal part of this district has already passed into the hands of English adventurers. Some of this property is really very good, particularly that lying in the main mineral belt of Treasure Hill. The mines of the Eberhardt and Aurora Company were the first in this district that were sold in the English market, and the present owners have good reason to congratulate themselves on their success in securing a first-class mining property. The mines here are generally looking well.

The Ward Beecher has a large body of excellent ore exposed in the various workings, sufficient to supply the mills of the company for one year to come. North Aurora, belonging to the same company, looks as well and has as much ore in sight as the Ward Beecher. The future success of this company is assured for the next two years at least.

The South Aurora Mine is for the present completely worked out. Prospecting, however, is actively carried on from the deepest workings, but with no good prospects of soon finding pay ore. The managers of this property have spent no inconsiderable sum in building extensive stone terraces on the side of the mountain, south of the mine, that are of no earthly use at present, nor is there any prospect of their future usefulness, except as monuments of useless and wasteful extravagance.

The Great Western Mine is also the property of an English company. This mine is a genuine untamed and untamable "wild cat."

The Troy mining property, situated in the Troy mining district, is 80 miles south of Treasure Hill. It was sold to an English company (limited) about a year ago. Since then much money has been spent on the mines, and a 15-stamp mill was completed about five months since, but it has failed to start operations, owing to some difficulty experienced in getting bricks for the purpose of building a Stetefeldt furnace.

The East Sheboygan Mine has been owned by an English company since August last. A fair property has been developed, and under good handling it would become a paying mine. The present management is, however, very loose.—[The *White Pine News* says—"A new strike was made this week in the face of the south original tunnel; also in the bottom of the East Exchange incline. A force of 26 men is now employed sinking and drifting to make connections. All the workings of the mine are improving in appearance. Carpenters are at work constructing ore-houses and other topworks."]

Manufacture of Alum.—The invention of Mr. B. E. Newlands, analytical chemist, of Charlton, relates to the treatment of native phosphates of alumina, such, for example, as the rodonda or other native phosphate of alumina, in order to obtain therefrom ammonia alum, and consists in, firstly, effecting the solution in sulphuric acid of such native phosphates of alumina as may be soluble therein. And after the separation of any insoluble matters, either by filtration or decantation, adding to the solution sulphate of ammonia, and after such addition if necessary, concentrating the same, and then allowing the ammonia alum to crystallise out therefrom; the mother liquors, having been separated, may, after further concentration, be allowed to cool, and a further portion of crystals be obtained therefrom.

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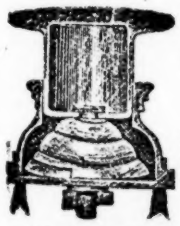

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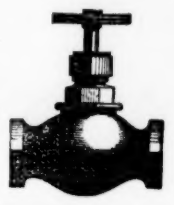

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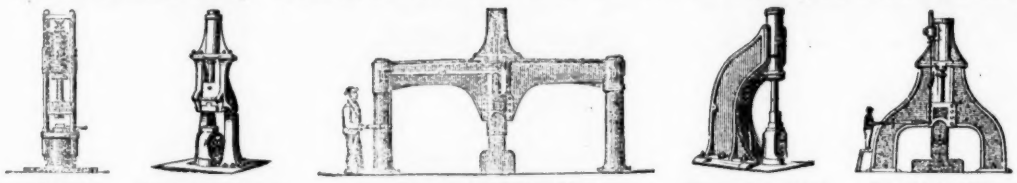

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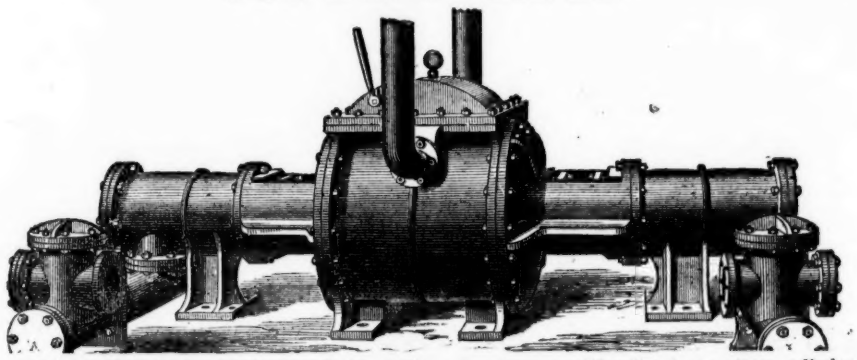

The Machine erected in South Wales (at the Broad Oak Colliery, Loughor, near Llanelly), has a steam cylinder 40 inches diameter and two plungers of 8 inches diameter, and is raising 15,000 gallons of water per hour, the steam-boiler being on the surface. This it does with the greatest ease, the pump-valves working with scarcely any perceptible sound. The length of the incline besides the vertical lift is at present about 250 yards. The pump is constructed to be moved down the working as it advances, and is calculated to force the water to a height of 700 feet through a horizontal distance of 490 yards. For full description see *Mining Journal, Colliery Guardian, Engineering*, &c.

Sole Makers, HAYWARD TYLER & Co., Hydraulic Engineers,

84 and 85, UPPER WHITECROSS STREET, LONDON, E.C.

CHAS. PRICE AND CO.'S RANGOON ENGINE OIL,

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For particular kinds of Machinery, the Oil may be specially prepared of a consistency and character adapted to the nature of the work to be done.

"Chemical Laboratory, 7, Printing House-square, Blackfriars, April, 1869.

"I herewith certify that the Rangoon Engine Oil, manufactured by Messrs. Chas. Price and Co., is free from any material which can produce corrosion of the metal work of machinery. It is indeed calculated to protect metallic surfaces from oxidation.

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WORKS: MILLWALL, POPLAR; and ERITH, KENT

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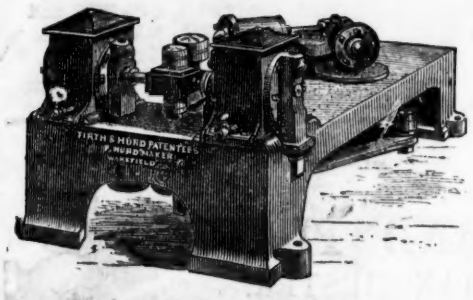
MILLWRIGHT, MACHINIST,

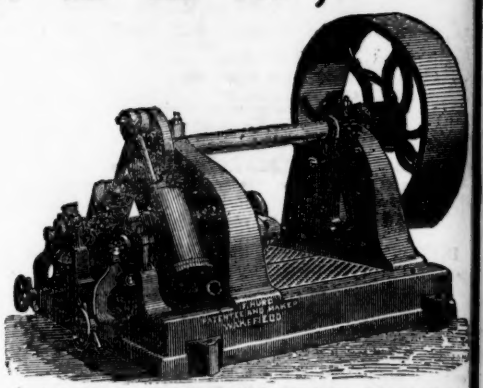
BRASS AND IRON FOUNDER,

ALBION FOUNDRY,

WAKEFIELD.



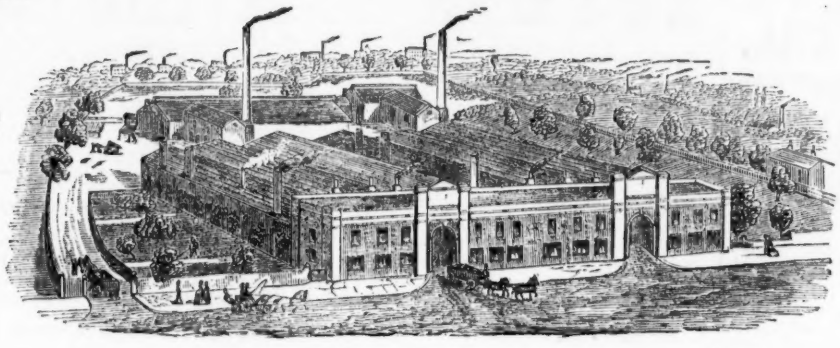
Patent Air-Compressing Engine.



Patent High-speed Reversible Engine, without the aid of Tappets, Cams, or Eccentrics. Cylinders either fixed or oscillating.

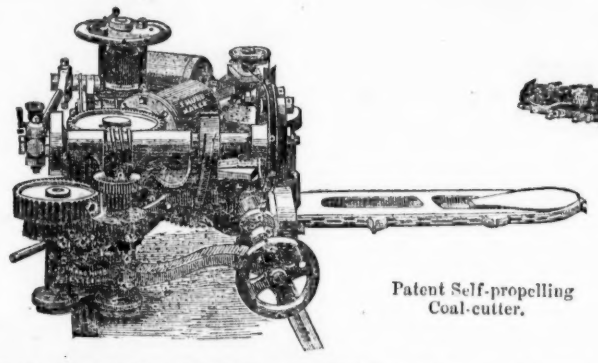
MANUFACTURER Of PATENT MINING and EXCAVATING MACHINERY.

FIRTH'S PATENT CANNEL HUB DRESSER.

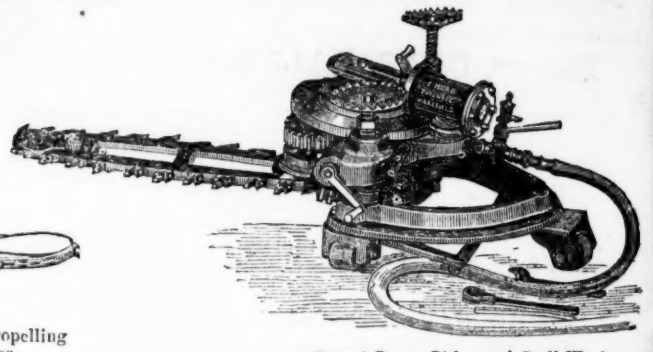


HYDRAULIC and AIR-COMPRESSING MACHINERY. Heavy, Light, and Ornamental CASTINGS, and Patent WORSTED MACHINERY.

Patent Power, or Hand Straight Work Coal-Cutting Machine.



Patent Self-propelling Coal-cutter.



Patent Power Pillar-and-Stall Work Coal-Cutting Machine.

Also, FIRTH'S PATENT ECONOMIC PERMANENT RAILWAY, without the aid of Pins, Bolts, or Wedges, that can be laid by an ordinary labourer with rapidity.

GENERAL CONTRACTOR; and Estimates given for Air-Compressing Machinery and Coal-Cutting Machinery on application

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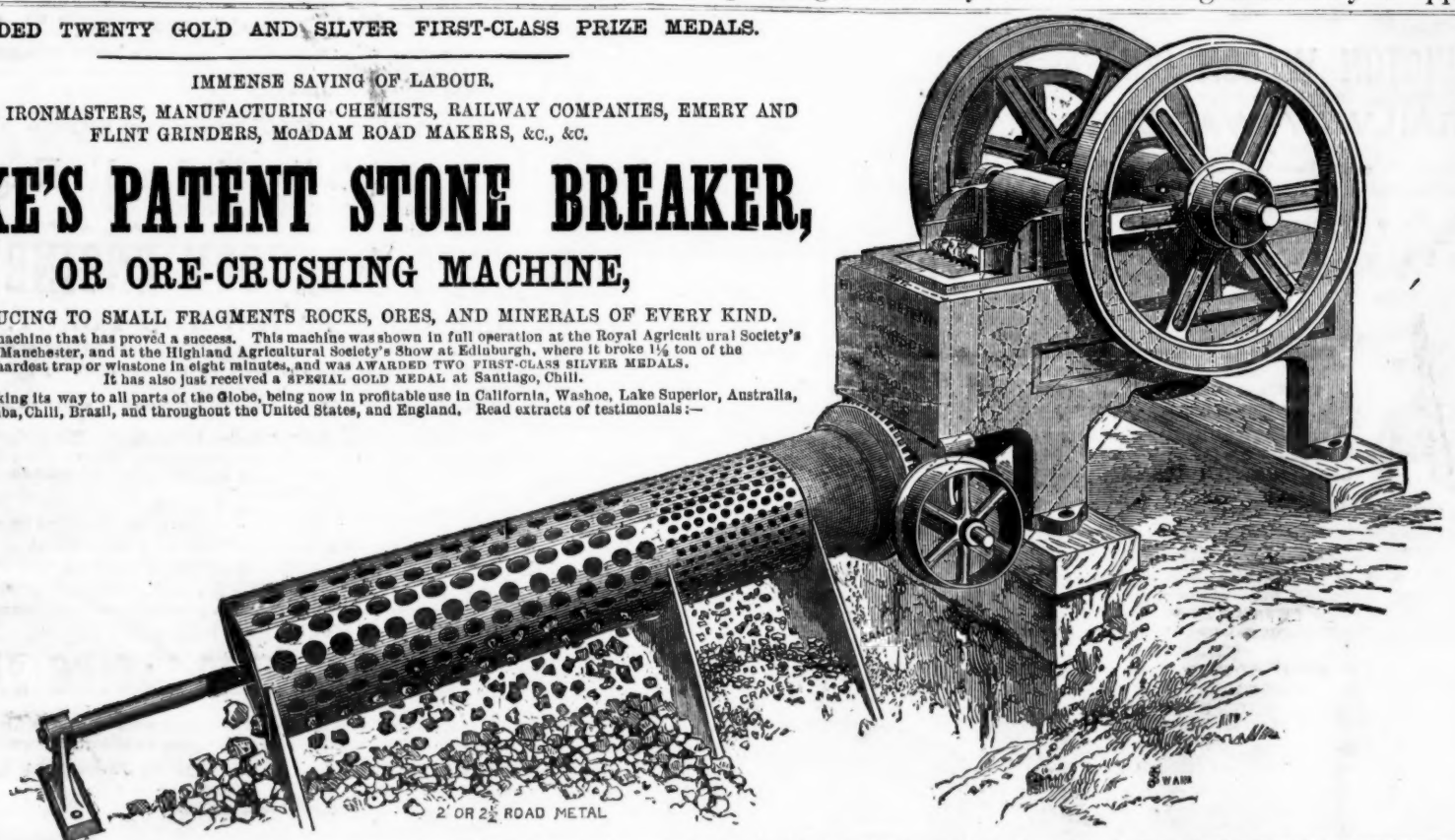
FOR REDUCING TO SMALL FRAGMENTS ROCKS, ORES, AND MINERALS OF EVERY KIND.

This is the only machine that has proved a success. This machine was shown in full operation at the Royal Agricultural Society's Show at Manchester, and at the Highland Agricultural Society's Show at Edinburgh, where it broke 1¼ ton of the hardest trap or winstone in eight minutes, and was AWARDED TWO FIRST-CLASS SILVER MEDALS. It has also just received a SPECIAL GOLD MEDAL at Santiago, Chili.

It is rapidly making its way to all parts of the Globe, being now in profitable use in California, Washoe, Lake Superior, Australia, Cuba, Chili, Brazil, and throughout the United States, and England. Read extracts of testimonials:—



The Parys Mines Company, Parys Mines, near Bangor, June 6.—We have had one of your stone breakers in use during the last 12 months, and Capt. Morcom reports most favourably as to its capabilities of crushing the materials to the required size, and its great economy in doing away with manual labour.
For the Parys Mining Company.
H. R. Marsden, Esq. JAMES WILLIAMS.

Acton Emery Works, Manchester.—We have used Blake's patent stone breaker made by you for the last 12 months, crushing emery, &c., and it has given every satisfaction. Some time after starting the machine a piece of the moveable jaws about 20 lbs. weight, chilled cast-iron, broke off, and was crushed in the jaws of the machine to the size fixed for crushing the emery.
H. R. Marsden, Esq. THOS. GOLDSWORTHY & SONS.

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Welsh Gold Mining Company, Dolgelly.—The stone breaker does its work admirably, crushing the hardest stone and quartz. WM. DANIEL.

Our 15 by 7 in. machine has broken 4 tons of hard winstone in 20 minutes, for fine road metal, free from dust.
Messrs. ORD and MADDISON,
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Kirkless Hall, near Wigan.—Each of my machines breaks from 100 to 120 tons of limestone or ore per day (10 hours), at a saving of 4d. per ton.
JOHN LANCASTER.

Ovoca, Ireland.—My crusher does its work most satisfactorily. It will break 10 tons of the hardest copper ore stone per hour. WM. G. ROBERTS.

General Frémont's Mines, California.—The 15 by 7 in. machine effects a saving of the labour of about 30 men, or $75 per day. The high estimation in which we hold your invention is shown by the fact that Mr. Park has just ordered a third machine for this estate. SILAS WILLIAMS.

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